THE MODEL ENGINEER

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The MODEL ENGINEER

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2ND AUGUST 1951 — VOL. 105 NO. 2619

SMOKE RINGS

Our Cover Picture

● MR. W. PHILIP CONOLLY, of Cheam, submitted the photograph from which we have prepared this week's cover. It clearly shows the unusual amount of superelevation on the through line at Penrith, on the London Midland Region's main route from London (Euston) to Scotland. Quite an effort is required to walk up the slope of the floor of one's carriage when one is detraining at this particular platform. We are not sure what is the maximum superelevation for track in Britain, but we believe it to be $3\frac{1}{2}$ in. The amount at Penrith must be quite that!

"M.E." Exhibition Posters

● THE VERY attractive poster for the 1951 " M.E." Exhibition is now ready, and we would be glad to hear from any readers who would be willing to display copies of the poster and distribute handbills. Anybody able to do this is invited to communicate with the Exhibition Manager, 23, Great Queen Street, London, W.C.2.

Model Galloping Horses

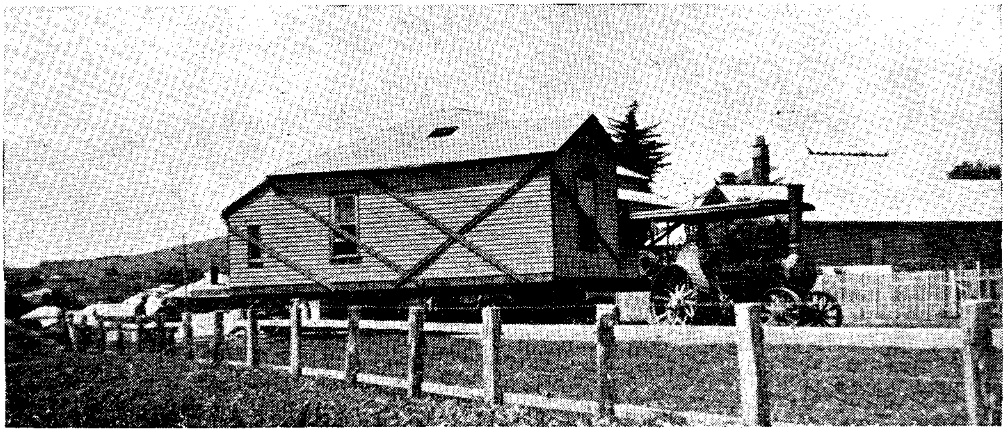
● THE LURE of the fair appears to be irresistible to some model makers, more especially at this time of year. As if to make up for the very regrettable rarity of the grand showman's road locomotive and the lack of interest in its successors, attention is being given more to some of the other items to be found on the fairground. From the Buxton Model Engineering Society's *Bulletin*, we learn that at Chapel-en-le-Frith there is nearing completion a fine model of a " galloping horses " roundabout which a Mr. Slack and some friends have been building for about seven years. It is a large model, approximately 7 ft. in diameter and about 4 ft. high. There are 30 horses in sets of three abreast, all cast in aluminium in three or four separate pieces. They are suspended from cranks in the upper part of the machine, by means of twisted brass rods. The roundabout is driven by a built-in engine and boiler of the correct type.

Driven by a separate engine mounted on top of the boiler, is an organ unit complete with cymbals, drums, etc. The actual tunes are supplied by an old gramophone which, according to the *Bulletin*, " sounds most realistic and true to type "!

The entire roundabout is built up and dismantled in exactly the same manner as a full-size one would be. It has yet to be painted before it can be said to be finally finished; but we hope that we shall be able to publish an illustrated description of this fascinating model.

House-moving Extraordinary

● THE PHOTOGRAPH reproduced here shows one method of house-moving which has been successful in Australia. The original print was loaned to us by Mr. R. R. Rivis, of Malton, Yorks, who borrowed it from a friend because of the interest of it and, to us, the novel use of a traction engine.



We think there is little room for doubt that the engine is a Fowler, though when we examined the original print under a lens we could see no trace of the familiar nameplate on the smokebox door. The photograph was taken at Victoria, Australia, in 1922.

The "M.E." Helps Again

● WE HAVE lately received a long, deeply appreciative and very interesting letter from a young reader who, for the present, shall remain anonymous, though we feel sure that more will be known about him before very long. He has made a model which, we believe, is the only one of its kind, and we are glad to learn that it will be on view in the loan section of the "M.E." Exhibition and is sure to attract a lot of attention. Incidentally, we learn that the authorities at the Science Museum, South Kensington, have taken interest in it.

Our young friend is an apprentice living in "digs" which, he says, does not help his model making ambitions. During the first month of his general light engineering training, he found an old copy of THE MODEL ENGINEER concerning which he writes: "It was really that friend of millions, 'L.B.S.C.', who caught my attention with photographs of some locomotives built by the Morse family. I would not have believed it possible for a $2\frac{1}{2}$-in. gauge coal-fired locomotive to work at all before then, but 'L.B.S.C.' made it all seem so easy that I decided to try. I managed to get a copy of THE MODEL ENGINEER most weeks and found the articles of 'Ned' and 'Duplex' were teaching me my trade almost as well as the paid instructors, and at the end of my year's engineering course, I was transferred to the research laboratories out in the country."

At this time he heard of the existence of the Chelmsford Society of Model Engineers, and promptly joined it. He fell in love with F. C. Hambleton's drawing of the L.B. & S.C.R. 0-4-0 tank engine, No. 400, and decided to make a gauge "1" version of it. Work on it proceeded well until lack of a lathe prevented further progress.

Then his employers built a rather special piece of equipment, and our young friend was one of those engaged on its construction; from memory, he made a 1-in. scale reproduction of it, using strip balsa and postcard. Being unable to paint it when it was finished, he began another! This time, after nine months' work, he has a complete model of which we have seen an illustration. We will leave the model to speak for itself at the "M.E." Exhibition. But our friend ends his letter: "May THE MODEL ENGINEER never cease to be published, and may there always be an exhibition of models to look at, to gain inspiration for more and better ones. I cannot thank you too much for your journal, as it is solely due to my model that I am in the good job I have now, and not working a capstan lathe!"

We like to know that THE MODEL ENGINEER has been of real help to a young man who is starting on what we hope will be a thoroughly successful career.

A Society at Dorchester

● WE LEARN that a Society of Model Engineers has been formed in Dorchester and we wish it every success. Judging by a letter from its chairman, Mr. C. F. Hallett, the new venture is in a promising condition; there are 15 members, and various models are in course of construction, including a "Doris" which is being built as the society's own locomotive.

The club is fortunate in having a workshop, which is situated at the Modern School, and meetings are held every Thursday evening from 7 till 9 p.m. There is plenty of room for more members, and any readers in the locality are invited to get into touch with the hon. secretary, Mr. W. M. Salmon, at the workshop, or with Mr. C. F. Hallett, at 55, Lorne Road, Dorchester.

*CONSTRUCTING A YEAR CLOCK

by C. B. Reeve

THE pinions were next taken in hand. These were made from standard pinion wire, but not in the orthodox way of solid pinions. A short length of the pinion wire, just sufficient to form the head, was cut off the length with the piercing saw. Next, a short length of brass rod somewhat larger in diameter than the piece of pinion wire was chucked in the three-jaw chuck, drilled and bored of such a size that the piece of pinion wire was a drive-in fit, care being taken to leave the wire just proud of the brass bush thus formed. The protruding end of the pinion wire was then faced off and turned as smoothly as possible. Afterwards it was centred with the Slocombe centring drill and then drilled through and bored a slow taper. Next, it was tapped out of the brass bush with a piece of rod passing through the mandrel and then replaced in the brass bush and the other end faced off. Afterwards, the leaves of the pinion head were well shaped with the aid of a knife-edge file finishing with carborundum grit No. 120 and oil, the grit and oil mixture being worked between the leaves with a small piece of end-grain wood. At this stage the pinion head was now hardened by heating to cherry red and plunging into cold water. Afterwards, it was let down to a purple blue and finally polished with rouge and oil. The pinion arbors were made from tempered steel rod (blued steel) which is now obtainable in lengths of about 6 in. A piece sufficient for one arbor was cut off from the rod, cone centred at each end, after which one end was taper turned to match the tapered hole in the pinion head. If this is well done the pinion head literally screws on to the arbor and will never move.

A short length of brass rod to form the collet for mounting the wheel on was pressed on to the other end of the arbor and a seating was then turned to such a size to suit the previously prepared hole in the wheel. The wheel was then riveted on to the collet. The latter was then finally turned to shape and finished off with buff sticks. All the wheels and pinions were treated this way, but the pivoting was left to be done later.

While in London on holiday I obtained the brass for the plates for the movement, also the brass tubing for making the weight cases. On unpacking these items it was noticed that the brass plates were far from flat, and knowing that brass of $\frac{3}{16}$ in. thickness would be no easy task to planish, the following method was tried out and proved fairly successful :

Each plate in turn was placed in the wood-worker's vice and two small pieces of wood arranged on either side of a hollow in the

*Continued from page 106, "M.E.," July 26, 951.

Data Table to Drawings

Reference	Description of items	Number of teeth	Full diameter (in.)	Width (in.)	Diametrical pitch	Quantity required
Fig. C. 35.	Front plate of movement ..	—	—	—	—	1
,, 36.	Pillar of small auxiliary front plate	—	—	—	—	4
,, 37.	Centre wheel of movement ..	96	1½	3/64	72	1
,, 38.	Pinion on centre wheel arbor ..	12	.185			1
,, 39.	Upper 3rd wheel of movement	90	1¼	3/64	72	1
,, 40.	Pinion of upper 3rd wheel arbor of movement	12	.185			1
,, 41.	Escape wheel dead-beat straight-sided teeth ..	30	1⅛	1/16		1
,, 42.	Pinion on escape wheel arbor	12	.185			1
,, 43.	Dead-beat adjustable pallets ..	—	—	—	—	2
,, 44.	Winding gear on arbor of great wheel	78	1 13/16	¼	40	2
,, 45.	Intermediate winding gear ..	36	.95	¼	40	2
,, 46.	Gear mounted on winding arbor	36	.95	¼	40	2
,, 47.	24-hour wheel	144	3	3/64	50	1
,, 48.	Hour wheel	72	1½	3/64	50	1
,, 49.	Minute wheel on centre pinion	44	⅞	3/64	52	1
,, 50.	Reversed minute wheel ..	44	⅞	3/64	52	1
,, 51.	Minute wheel clock	—	—	—	—	—
,, 52.	Bridge for hour wheel ..	—	—	—	—	—
Fig. D. 53.	Pillar to main clock frame ..	—	—			6
,, 54.	Weight case	—	3	Length :	15 in.	2

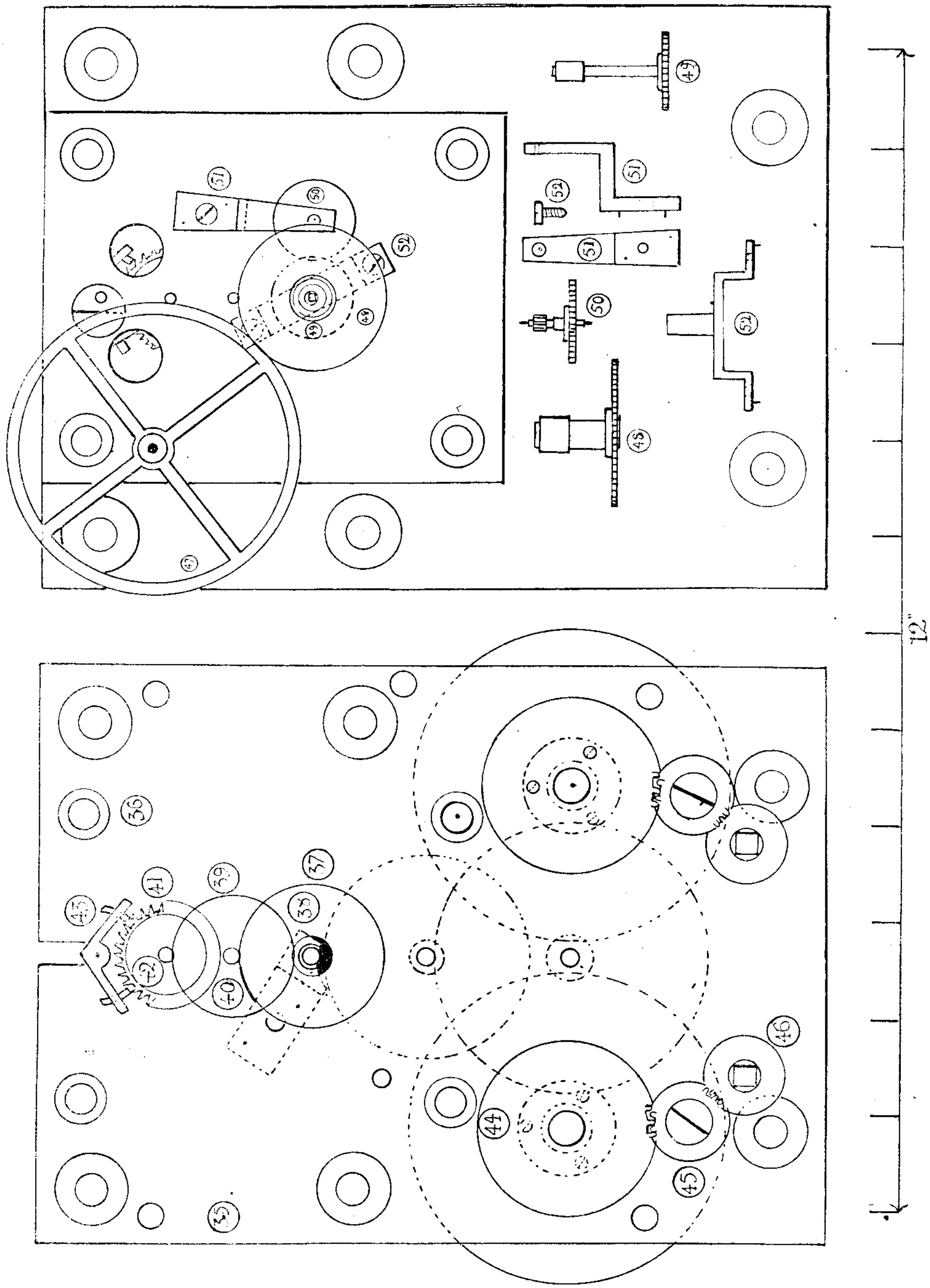
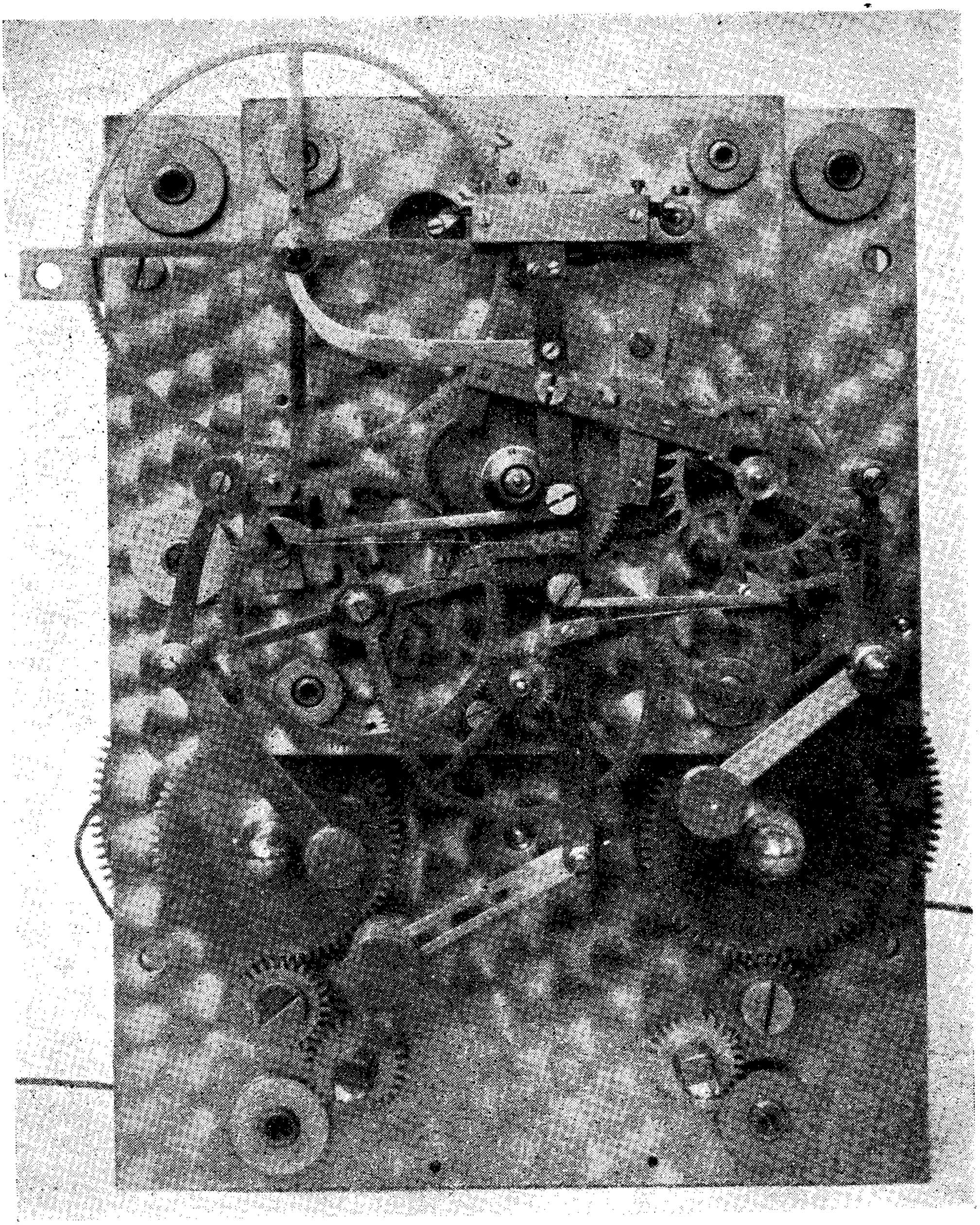


Fig. C

plate while a third piece of wood was placed on the opposite side of the plate immediately over the bump. The jaws of the vice were then carefully closed, causing the bump to be flattened out. Both plates were gone over thus and although the result was not exactly surface-plate finish, it was reasonably good for the purpose in hand.

Pillars were then made. This was a straightforward turning job, the ends being threaded with a fine pitch home-made die ; after this, ring nuts were made and tapped to suit the ends of the



Front view with cam wheel and finger removed

pillars. The plates were now drilled to receive the pillars. After fitting the pillars, the frame was ready to assemble and it went together quite well. The various wheels and pinions were now laid across the edge of the frame and it was then easy to see to mark them out for the pivots to be turned. The turning of the pivots was done with a graver and handrest, running the work fairly fast in the lathe, and afterwards they were smoothed with a pivot file followed by oil-stone dust on a polisher, and finally finished with rouge and oil. The next operation was the planting of the train of wheels in the frame. This was accomplished without any mistakes with the aid of a depth tool.

By the end of the writer's two weeks' holiday, all the inside wheels were planted and also the upper wheels contained between the main front-

plate and the upper small auxiliary plate. It will be seen from the drawing that the back pivot of the centre wheel is held in a cock screwed to the underside of the main front plate, the pinion on the centre wheel arbor engaging with third wheel of the train. After this the work progressed rather slowly, being mainly done at week-ends; but by Christmas, 1949, the dead-beat escapement and pendulum were made and the exciting moment arrived when it was possible to see if the movement would go. As the weights had not yet been made, weights from other clocks were quickly borrowed and a short length of wire line was attached to each barrel. A total weight of about seventy pounds on a double line was required to get way on the wheelwork. After adjusting the crutch in beat the clock was started, and, strange to say, it went for the first time of asking. The pendulum rating-nut was adjusted by pure guesswork and the movement was left going for a fortnight during which period it kept time with Big Ben within a minute or so. It was then decided to add the perpetual calendar attachment.

This part of the job took about three months to construct, and the following is a brief description of its action, which is on Broco's principle:

The drawing of the calendar work shows the various parts as they appear with the clock dial removed. The large gear wheel in the north-west corner contains double the number of teeth of the hour wheel with which it meshes, and, therefore, makes one revolution in twenty-four hours. There is a pin situated in one of its arms which, as the wheel turns anti-clockwise, moves the lever to the right, which in turn moves the big arm or detent also to the right. Attached to the detent are two clicks and weak springs pointing in opposite directions to one another. That on the left is for moving the seven days of week star wheel, whilst that on the right is for moving the thirty-one days of the month wheel. As the detent travels towards the right, the two clicks will slip past a tooth of their respective wheels without the wheels moving in any way, but when the pin in the twenty-four hour wheel has moved past the extremity of the curved arm, the detent will suddenly return again to the left-hand position and in so doing both clicks will advance their respective wheels one tooth. This happens every time the detent travels to the left, whether it happens to be a short or long month. It will be seen from the drawing that the week and month wheels are steadied in their positions by rollers shouldered on screws fitted to arms; the lower extremities of the arms carry light weights. This idea, the writer considers, is better practice than using springs. A similar weighted arm is also used for returning the detent.

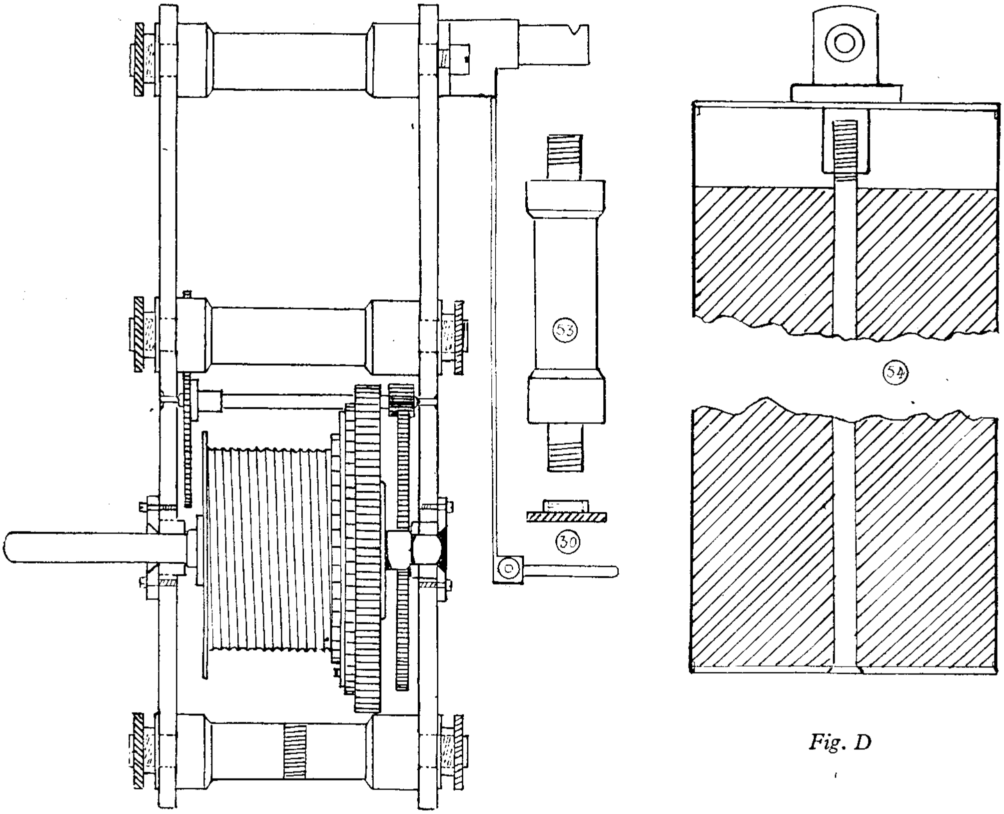


Fig. D

(To be continued)

Model Power Boat News

by "Meridian"

WHEN the first "surfacing" hydroplanes were seen in action a few years ago, a certain amount of criticism was forthcoming, mainly on the lines that only the support of the tethering bridle and running line made surfacing possible. It is gratifying to note, therefore, that the American holder of the world's water speed record uses this means of propulsion. Besides recording 160 m.p.h. on the straight, *Slo-Mo-Shun IV* won the British International Trophy (held by America) at an average of over 90 m.p.h. steering exceedingly well round a set course. Other full-size examples of surface propellers include a hydroplane engined with a Ford Vee-8 that has achieved 115 m.p.h., the highest speed ever attained with an engine of this capacity. It is understood that Donald Campbell's *Bluebird*, too, has been modified to enable her to surface and recently won an important event in Italy.

It appears that the gain in speed is perhaps from 10 to 20 per cent. over the fully submerged type of propeller, and this is probably due to the greatly reduced underwater drag, since this amounts to the propeller blades only.

Returning to model speed boats; there seems to be no hard and fast rules to apply when constructing a surface-propeller boat. Like many other aspects of model hydroplane design, the method of trial and error is the most popular, and what works well for one craft will be a washout on another!

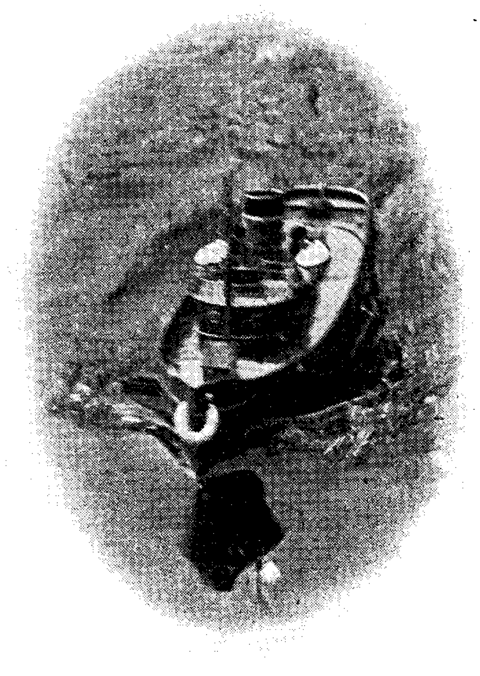
From examination of many of the successful surfacing boats a few conclusions may be drawn for the benefit of the intending constructor who may be new to speed boat work.

(*a*) The thrust line seems to be an important factor, in most cases the thrust line when produced would come out on or near the tips of the planes or sponsons when viewing the side of the boat.

(*b*) Planing angles are fine, less than 10 deg. when the boat is in normal running position. It is useful if the sponsons can be made easily adjustable in new boats, as this enables the best position to be ascertained without dozens of trips to the pondside.

(*c*) In order to prevent "flipping," the frontal area of many hulls are reduced to a minimum, this gives rise to "getaway" troubles in some cases. The boat may dive under upon being released, due to insufficient hull area forward of the c.g. In order to prevent diving, some exponents use a terrific throw to start the boats on their way. It is better to have a boat that will pick up speed on its own account, rather than rely on the throwing method, as it is an easy matter to muff the throw! It is suggested that a *reasonable* reduction of hull area, combined with good streamlining, and the c.g. well forward, is a good compromise.

(*d*) Surface propellers do not work properly until the boat is moving fast. This is another reason for the "throwing" release, but here again, some boats seem to pick up speed by themselves, but others will not go if released in the normal way—the propellers simply churn up water without moving forward. This behaviour appears to depend largely on the weight of the boat, amount of hull area, and the depth of submersion of the propeller when stationary.

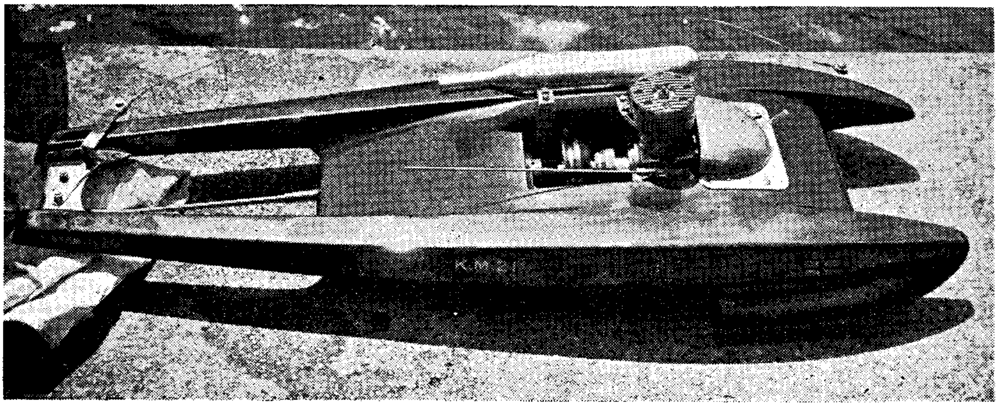


The petrol-driven tug "Canda," by Mr. A. Perkins (Victoria)

As regards the size and design of surface propellers, it may be said that most engines are happy with a slightly larger propeller than when driving a fully submerged one, and that two-bladed propellers of identical design to those developed for working fully submerged are used successfully. It is known that one club, at least, are experimenting with multi-blade propellers with quite good results.

Recent Regattas

The Annual Regatta of the Blackheath M.P.B.C. attracted a good entry, and some high speeds were attained by the racing boats. For the first time in this country a Class "A" boat recorded over 60 m.p.h. in an official regatta.



Mr. G. Stone's latest entry in the "C" class (restricted), "Bill Barnes"

This was E. Clark's *Gordon* 3, the successor to *Gordon* 2, but having the same engine installed.

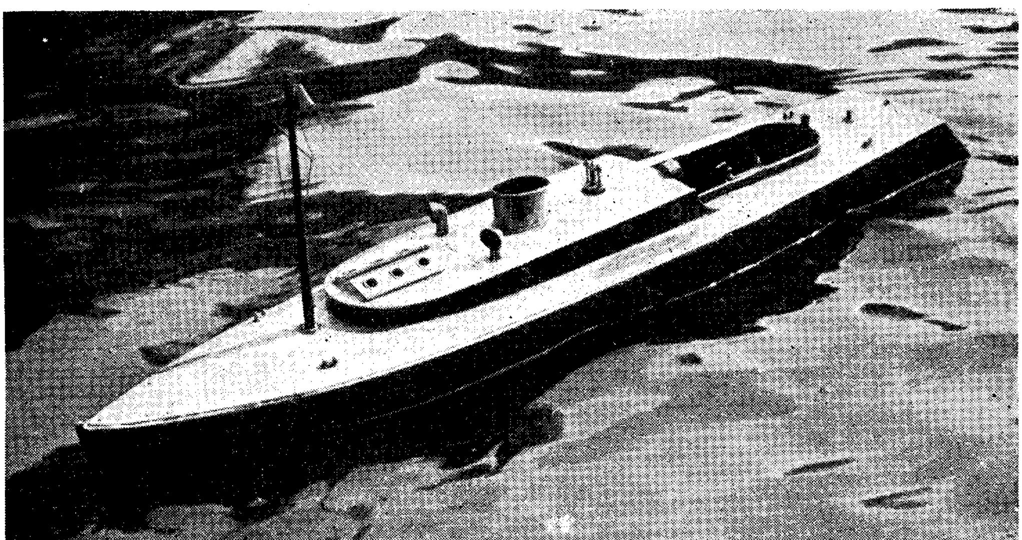
The winning speed in the Class "B" race was 57.6 m.p.h. by G. Line's *Sparky II* and G. Stone recorded a win at 50.3 m.p.h. with *Bill Barnes* in the "C" Restricted Race.

Besides the usual events for both straight running boats and racing hydroplanes, there were two extra prizes put up. One of these was for the straight running boats, and took the form of Re-nomination event. After each competitor had made a run in the 50 yd. Nomination Race, he was invited to have another guess as a result of his boat's performance, the original nomination to stand, however, for the race. This "extra nomination" had not been advertised and came as a surprise to most of the competitors.

For the speed boat exponents, there was a prize for the competitor to start and release his boat in the shortest time—the boat to complete the course in order to be eligible. The winner, G. Lines, took only 4 sec. to start and release *Sparky II*, though G. Stone had a good try with *Lady Babs II* but failed to finish the course.

The steering boats found the Blackheath course a tricky one, and scoring was low. Towards the end of the competition, A. Rayman (Blackheath) looked set to beat the score of 8 made by F. Curtis (Kingsmere), having scored a total of 6 on the two first runs, but three-quarters of the way to the target an engine failure caused *Yvonne* to register a "duck" for the last run.

Over 50 boats, from many different clubs, including Bournville and Guildford, took part in the regatta, which turned out to be one of the best ever held by the Blackheath Club.



Another of the Vanner straight-shooting veterans—the steamer "All Alone"

Results

50 yd. Nomination Race

1. W. Griffiths (Blackheath), *Orangeleaf*: error 1.22 per cent.
2. H. Whiting (Orpington), *Eileen*: error 4.7 per cent.
3. J. Jepson (Blackheath), *Darky*: error 6.9 per cent.

Re-nomination: J. Benson (Blackheath), *Comet*.

300 yd. Class "C" Race

1. R. Phillips (S London), *Foz II*: 45.2 m.p.h.
2. L. Pinder (Kingsmere), *Rednip*: 39.5 m.p.h.
3. J. Benson (Blackheath), *Moth II*: 32.7 m.p.h.

300 yd. Class "D" Race

1. Mr. Hyder (Victoria), —: 41.2 m.p.h.
2. W. Everett (Enfield), *Jaffa*: 39.4 m.p.h.
3. J. Wright (Kingsmere), —: 27.6 m.p.h.

300 yd. "C" Restricted

1. G. Stone (Kingsmere), *Bill Barnes*: 50.3 m.p.h.
2. S. Poyser (Victoria), *Rumpus* 2: 43.9 m.p.h.
3. S. Poyser (Victoria), *Rumpus* 3: 40.9 m.p.h.

Steering Competition

1. F. Curtis (Kingsmere), *Korongo*: 8 pts.
2. J. Jepson (Blackheath), *Darky*: 7 pts.
3. E. Walker (Kingsmere), *Coron*; A. Rayman (Blackheath), *Yvonne*: 6 pts.

500 yd. Class "B" Race

1. G. Lines (Orpington), *Sparky II*: 57.6 m.p.h.
2. F. Jutton (Guildford), *Vesta II*: 48.5 m.p.h.
3. N. Hodges (Orpington), *Sparta*: 38.7 m.p.h.

500 yd. Class "A" Race

1. E. Clarke (Victoria), *Gordon* 3: 62.3 m.p.h.
2. K. Williams (Bournville), *Faro*; J. Innocent (Victoria), *Betty*: 53.3 m.p.h.

Orpington S.M.E. Regatta

This regatta was held at Victoria Park, with the co-operation of the Victoria M.S.C., the following week, and received excellent support. The steering boats were well represented, a contingent from the Southend Club helping to swell the numbers.

In the speed events, the reliability standard was not up to usual, but some good speeds were recorded by some of the winners and runners up. G. Lines (Orpington) with *Sparky II*, recorded 58.4 m.p.h. to win the Class "B" event and both the "A" and "C" classes were won at over 55 m.p.h.

An interesting new "baby" flash steamer by A. Cockman (Victoria), *Ifit* 8, took second place in the Class "C" race, and looks very promising. The winner of this race was R. Phillips (S. London) with *Foz II* at 55.28 m.p.h., the highest regatta speed put up by this boat up to now.

The Steering Competition was the last event to be held, and well over 30 boats were competing, most of which were steering well; in fact, the steering was the best seen this year. "Bulls" were prolific, and ten boats scored at least one

Mr. E. A. Walker (Kingsmere) starting his petrol-driven cruiser "Coron" at Blackheath

in the event. The winner was Ted Vanner, with *All Alone*, and his score was a maximum—3 bulls! T. Curtis (Victoria) was second with *Micky*, 13 pts., and three boats had to re-run for third place. These were owned by Messrs. Newcombe, Chandler and Benson, and resulted in a win for the last named.

Results

80 yd Nomination Race

1. M. Chandler (Southend), *Mary*: 1.56 per cent. error.
2. J. Benson (Blackheath), *Comet*: 2.35 per cent. error.
3. E. Vanner (Victoria), *All Alone*: 2.98 per cent. error.

300 yd. Class "D" Race

1. W. Everett (Enfield), *Jaffa*: 39 m.p.h.
2. E. Woodley (Enfield), *ED* 2: 31.47 m.p.h.

300 yd. Class "C" Race

1. R. Phillips (S. London), *Foz II*: 55.28 m.p.h.
2. A. Cockman (Victoria), *Ifit* 8: 35.8 m.p.h.

300 yd. "C" Restricted Race

1. W. Everett (Enfield), —: 36.5 m.p.h.
2. J. Bonny (Victoria), *Ann*: 34.0 m.p.h.

500 yd. Class "B" Race

1. G. Lines (Orpington), *Sparky II*: 58.4 m.p.h.
2. N. Hodges (Orpington), *Sparta*: 35.9 m.p.h.

500 yd. Class "A" Race

1. E. Clarke (Victoria), *Gordon* 3: 55.28 m.p.h.
2. J. Innocent (Victoria), *Betty*: 46.5 m.p.h.

Steering Competition

1. E. Vanner (Victoria), *All Alone*: 15 pts.
2. J. Curtis (Victoria), *Micky*: 13 pts.
3. J. Benson (Blackheath), *Comet*: 9 pts. (After re-run.)

*TWIN SISTERS

by J. I. Austen-Walton

Two 5-in. gauge locomotives, exactly alike externally but very different internally

I DO not, as a rule, care to let an issue go through without putting in something to further the actual constructional progress of the "Twins." But, having cast a fishy eye over the usual pile of letters on my desk, and reminded you that a pile of letters means a pile of queries as a rule, I will enslave myself to the task of bringing to light some of the questions that may have interest for all readers.

The thing that strikes me most forcibly is the number of alternative machining methods that are suggested in place of my own recommendations. I do not mind this; in fact, I *like* it. As I have pointed out in my replies, most of the alternatives are sound, practical propositions that are worth noting and remembering, and very often these can be called up for dealing with a machining problem that cannot, for some reason, be dealt with in any other way.

Let me give you an example; one of my builders disliked the way in which the steam passages broke out at the ends of the bore. He points out that, apart from anything else, the uneven spacing of the studs for the cylinder covers leaves a weakness. This weakness may be only a theoretical one—I say this because I have not heard of any cases of actual failure or leakage, but nevertheless, there it is for all to see. His remedy was to cut the ports and passages, leaving the bore of the cylinder only roughly machined.

He then made up two rings which were let into bored recesses in the ends of the cylinders, and brazed or silver-soldered them in position. Needless to say, the passages were broken through into the actual bore, just behind the rings. This enabled him to set out the cover studs equally, whilst the machining of the finished bores presented no difficulties, and the false rings "disappeared."

I can see only one snag, and that is in finding that the break-through of the passage might be too far down inside the bore of the cylinder, causing the piston to cover it when at its extreme positions. Apart from this, there is no reason why the expedient should not be adopted, unless the builder is against doing the extra work it naturally brings. In the case of the cast-iron cylinder, however, it has just occurred to me that brazing might not be too good a job—how about a ring to *screw* in?

But now, here is a straight problem. A reader tells me a story of complete success in lining up cylinder, guide bars, and motion plate as recommended by me recently; he tells me that the clamping down to a surface plate dodge, worked out better than expected, and everything ran like velvet; but when he came to try out the assembly on the frames, instead of everything going stiff and "haywire" as he was warned it might do, he encountered a snag that was not mentioned at all. To his dismay, the top edge of the motion plate came about $\frac{1}{16}$ in. above the lower frame line, and there he was, all hot and bothered, adding up dimensions, left, right and centre, and still unable to track the origin of the offending error.

I did some checking up myself and could find nothing amiss with the drawings, and eventually came to the conclusion that a multiplicity of very small errors was most probably the cause. I gave him the dimension that really mattered—the centre line of cylinder bore from the top frame edge; incidentally, I gave it him *wrong*, stating $1\frac{3}{8}$ in. instead of $2\frac{3}{8}$ in. (quite obviously) but I expect he twigged the mistake.

Taking a much broader view generally of readers' letters, I gained the distinct impression that I have still managed to keep ahead of the builders, but not by a very large margin. I have just failed to clear the next major drawing in time for this issue, but by next time you should have enough work to keep you busy for a further spell. I have just about managed to arrange for builders to get busy boiler-making (pronounced "copper spoiling") by the time the hot weather (if any) has taken final leave of this year of grace. (Did I hear something?), and so with all excuses made and the path cleared, I will pass on to—

The Burning Question

It would be fatuous to make further comment on the material question, and just plain vulgar to give my considered views on the present state of the country and the world generally; but look here, chaps, what on *earth* are we going to do about getting our metals for future locomotives? I know the provident folk have laid in stores of the affected materials to the extent of making themselves poor for the next year or so, but how will the newcomer fare in the scheme of things? We cannot all be old hands at this game, nor can we of necessity have the required currency at our disposal for large purchases of metal. I have, in the past, praised the average model engineer for his clever use of scrap, but one cannot *specify* the particular needs of a locomotive on that basis. Scrap is worth its weight in gold for hundreds of small jobs, and often fits in exactly with the needs at hand; but, on the other side, it may not.

I expect you know what my main target is—boilers, and that can mean little other than copper. Or does it? Let us take a look—a good, sober and sensible look. Steel boilers, or even

*Continued from page 28, "M.E.," July 5, 1951.

iron boilers; what really does happen to a steel boiler on a small locomotive in the course of time? Assuming the boiler to be made of ordinary mild-steel, what happens to it, and how soon? If the metal is unprotected by galvanising or other surface treatment, it will pit quite generally over its entire inside surface to a depth of from $\frac{1}{16}$ in. to 3/32 in., and then more or less stop or slow down. By then, unless the boiler is made from truly massive material, it will be unsafe to use.

Time? About two to three years where the engine is steamed a dozen or more times a season. If the user takes the precaution of blowing down his boiler dead dry *immediately* after use, and sealing it up from the outside air at the same time, he may gain a further year's life for the boiler, but that's about the safe limit. Calling it three years at the outside safe limit is a poor investment, knowing how much work goes into it initially, and would scare off most people.

"Lowmoor" iron, if it could be got, offers a much higher resistance to pitting, even when unprotected, and a boiler's life might be extended to five years. Still not worth it!

A Solution and Snags

Galvanising appears to offer the complete solution, but there are some serious snags. First of all, it is not fool-proof, as we know from experience from our hot water tanks; it is quite a common thing for a tank to spring minute leaks from small rusty patches that seem to come from nowhere. Often these are caused by the fitters leaving iron filings in the tanks when new; the filings themselves rust, and that will eat through the zinc coating where they finally settle. The remedy, of course, is to clean out the tank with a powerful magnet, and this should be done when the tank is *new*. (Hot water fitters, please note.)

If you had a small boiler galvanised, even assuming the zinc coating was without "holidays" anywhere, you would still have to do some drilling and tapping for backhead fittings, and the local protection would be lost. Somehow, I don't like the idea. But as galvanising is going to be as difficult as metal itself, from the availability angle, we might as well forget it, except that it is a short life solution for the man who *must* have an engine at all costs. There is another disadvantage with the galvanised boiler, and that is its propensities for violent priming; this phenomenon goes on until the boiler is almost too full of scale to be even mildly efficient, and you know what that means to a small boiler.

How about a tinned boiler? The trouble here is that if the boiler were to be welded up, the tinning would be burnt off over quite a large area, and pickling and re-tinning might have as many potential pin-holes in its surface to produce the same risks as in the galvanised version; I'm afraid I still don't like the idea.

There is here, another alternative, though not a very happy one. A tinned steel boiler, riveted and sweated, would no doubt preserve the coating, but we would be back with all the old problems of the soft-soldered boilers of years ago, and I for one, remember with considerable anguish, the leakage troubles with which we had to contend; it's not a solution I would champion, personally.

I have before me a catalogue of material that is, at the moment available, and that is refreshing in itself. The material offered is stainless (or rustless) steel. In line with other metals, the prices do not compare at all badly, in fact, the comparison is quite favourable. Take, for example, the maleable grades of the steel, and which lend themselves to good, clean welding in self-material. There is grade F.D.P. which is commonly used in the manufacture of large acid stills and quite a few chemical pressure vessels. You get absolute reliability here, with easy welding, and easy working, and all the strength characteristics needed. Apart from this, a welded steel boiler is much easier to make, as the heating is purely local, and can be carried out with a much smaller flame than would be required for brazing or sifbronzing a copper boiler of equal size.

It might be possible to make up the parts, and silver-solder or braze them together with the aid of an ordinary petrol or gas-air blowlamp. I'm not quite sure of my ground here, and will try to find out; I know that some grades of stainless will not take at all well to silver-solder, and I assume that brazing would be just as tiresome.

Taking the heat conduction figures, we know that there would be a drop on the copper figures, but I believe that normal copper fire tubes might be used without the danger of setting up electrolytic action—at least, for some grades. This combination would bring us somewhere near the ideal; it is in the tubes that we rely so much on the heat conducting qualities for good steaming—even more than in the firebox itself (treading on dangerous ground here, so will add "in my opinion").

But that final combination again depends on the availability of the copper for fire tubes, but at least it has solved *part* of the problem. One has a much better chance of laying hands on the small diameter stuff than on the $4\frac{1}{2}$ in. to 6 in. dia. material.

And failing copper altogether? That would bring us back to the fire tubes in stainless material as well, but this *is* available. Doubtless it would mean a different spacing and arrangement for the tube nest, in order to make up for the loss in conduction quality of the steel.

A Promising Alternative

Of all the alternatives considered, I think the last one is the most promising. I do not think anything will quite come up to the excellence of copper for boilers, but we are not trying to compete with that metal—we are just trying to plan out a satisfactory alternative, if needs be.

Now all that I have said is for the benefit of the locomotive man who does long and serious work with his engine, and who wants a job that will last a reasonable number of years. There are also men who build locomotives, and build them very seriously, but not for general use. They derive their pleasure more from the building than from the operation point of view, and it is much easier to satisfy their needs. Quite an

ordinary steel welded boiler should satisfy them ; if the finished article will withstand an hydraulic test, and it is *capable* of being steamed if required, then I think their consciences will be happy. Believe me, quite a high percentage of the better-class exhibition type, super-detailed locomotives are considered to be too good for serious work, and spend their entire lives under glass cases or on special shelves, just to be studied and admired. This does not happen to be my particular line, but I can still admire a job for its detail and workmanship, and would gladly have both to satisfy my own love of engines—but not the one by itself, I'm afraid. Perhaps when I get older, I will have to be content with just looking and admiring, but the love will be just as strong.

But now, going from the difficult to the impossible for a change, I want to tell you about a recent experience of mine ; I say " impossible " because it is just one of those things that do not happen in this country any more—but let me explain.

No. 11, and Five Coaches

We have just had a holiday in the Isle of Man ; the first ten days break since the early years of the war. We saw the T.T. races, and did a bit of roaming round the island, and it was not long before I got nosing around in Douglas railway station. Somehow, I found myself in the engine sheds, where one of the drivers—a charming and most affable fellow, finding that I could talk his language, soon made friends. I was on the point of leaving, when he asked me whether I was in much of a hurry, and on my saying that I was not, he suggested that I should get in the next train and alight at the next station—Union Mills.

I found the train, a five-coach outfit, nearly overflowing with school children going home, but found a seat near the front end. When I got out at Union Mills, the driver beckoned to me to come up on the footplate, saying, " There you are, friend, she's all yours." After a lot of coaxing and persuasion (!), I agreed to take over as far as St. Johns—a couple of stations away.

I didn't know the road, of course, so took things steadily, running into St. Johns about a minute late.

Incidentally, it is a single line, staff working, with loops at the stations, and the thing that struck me most was the gradients that occur with great frequency ; there is a 1 in 65 for about two miles out of Douglas, and that makes the old girl puff a bit. The only real gradient I met was coming into St. Johns, and that was downhill, with quite a sharp sweeping curve keeping the distance well out of sight. The absence of brakes might have upset some folk, and the combined ejector was turned off at the fountain. The driver did turn things on for my benefit, but we found so much steam and hot water flying about from a leaking valve, that it just had to be shut off again. The fireman seemed to know and understand the hand brake in the bunker, and he used it with great skill ; but I was advised to put the engine in reverse gear in case of really urgent need. I did not have the chance to find out what this felt like !

What a luxury to have a real live fireman to hand, and no fire or water worries besetting one ; the driving was all too easy ! It was agreed between us that the pair of them had no objection to my putting this experience in print, but out of respect for them I will refrain from giving their names in full. Thanks a lot, Driver C. and Fireman H., a most enjoyable afternoon, and what Mrs. A.-W. said when I rolled into the hotel in a fairly begrimed condition, is, as Kipling would have said, another story.

All that is needed to illustrate the above story are the pictures. I did take a couple, but the camera had developed a fault in the bellows, and my tame photographer is still trying to save the negatives. Later perhaps, I may be able to get some prints sufficiently clear for reproduction here.

The Sad Story of the Week

The man who went up to the works, and asked for an offcut of copper tube, 6 in. dia. by 6 ft. $4\frac{1}{2}$ in. long. He leaves a widow and two very ugly children.

(To be continued)

B.R. Locomotive Drawings

THE Railway Executive has decided that, in order to meet a demand from enthusiasts and modellers for drawings of the new standard locomotives, arrangements shall be made to issue two different types of such drawings in respect of certain of the standard engines. The first and simpler publication is a dimensioned outline diagram of the engine (with the tender, where applicable, shown separately on the same sheet) to a scale of $\frac{3}{8}$ in. to 1 ft. All the principal dimensions are clearly shown, and there is more detail included than is usual in drawings of this kind. These diagrams are sold at 2s. 6d. each.

For the expert student and model maker, general-arrangement drawings to the scale of $1\frac{1}{2}$ in. to 1 ft. will be available of the Class 7 4-6-2, Class 4 4-6-0 and Class 3 2-6-2 tank. These drawings will include cross-sections, on a separate sheet, as well as drawings of the valve assemblies, smokebox arrangement, cab and other important details ; the prices will vary with the cost of production. At present, only the " Britannia " class is available, at 10s. for the engine and 8s. 9d. for the tender, including postage.

So long as paper supplies permit, the diagrams and the general-arrangement drawings can be obtained on application through any of the Regional Public Relations and Publicity Officers of British Railways.

*" That Wonderful Year . . . . ."

by " The Dominie"

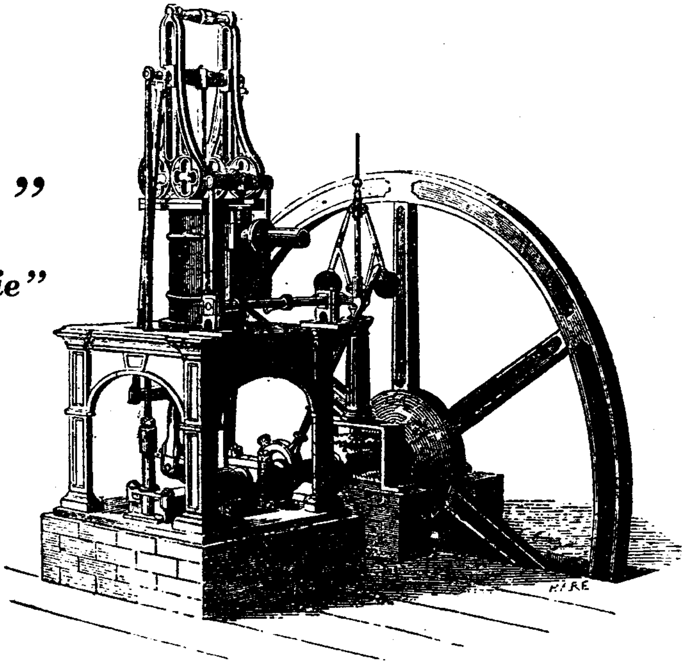


Fig. 37. *The decorative " architectural " features of this " improved non-condensing expansive table engine," by Tuxford's, are typical of the early Victorian era*

WELL, we have still time at this magnificent Great Exhibition of 1851 to inspect some of the stationary steam engines on view, and the first to catch our admiring eye is the table-engine by Tuxford of Lincoln (Fig. 37). Of ornate design and finish, the whole engine is typical of the unnecessary complication and ornamentation which is one of the charms of Victorian examples of engineering—indeed, of Victorian life in general. The cylinder stands on a table, and the piston-rod drives a cross-head from which a wide-forked connecting-rod drives down to the overhung crank. The valve is driven through eccentric, rocking-shaft, and twin side-rods : in motion the whole engine presents a fascinating study. These engines are built from two to eight horsepower, at prices from £150 to £300.

**Continued from page* 94, "*M.E.," July* 19, 1951.

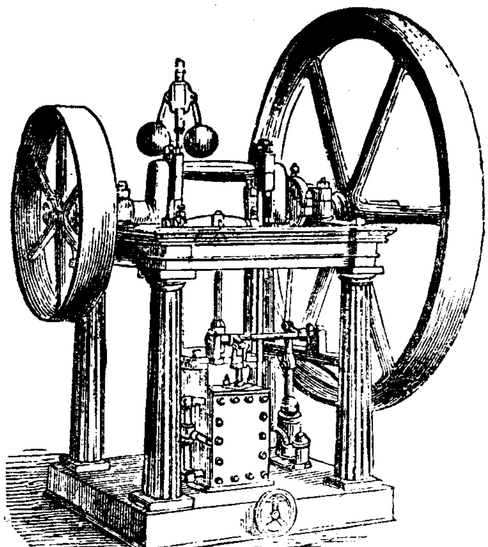


Fig. 38. *This engine built by Tuxford's is the same type which was fitted to their all-enclosed portable engine, which was illustrated earlier* (*Fig.* 16)

Another type of engine built by Tuxford, which like the last example would make a lovely model, is that shown in Fig. 38. In this case the piston-rod drives up to a cross-head, from which side-rods drive downwards, their lower ends being guided by slides on the sides of the cylinder. From the lower ends of these side-rods a pair of connecting-rods drive up to the crankpin, which is, of course, longer than the cylinder diameter. The slide-valve is worked by eccentric and rocker-shaft, and the water-pump by a rod directly attached to the rocker-arm.

Clayton and Shuttleworth are showing an eight horsepower oscillating-engine (Fig. 39), and the valve-motion is worth examination, because it is similar to that of many of the huge oscillating marine-engines. The eccentric-rod works a curved slide or link, which can move up or down between the short machined faces on the vertical columns. Steam passes through

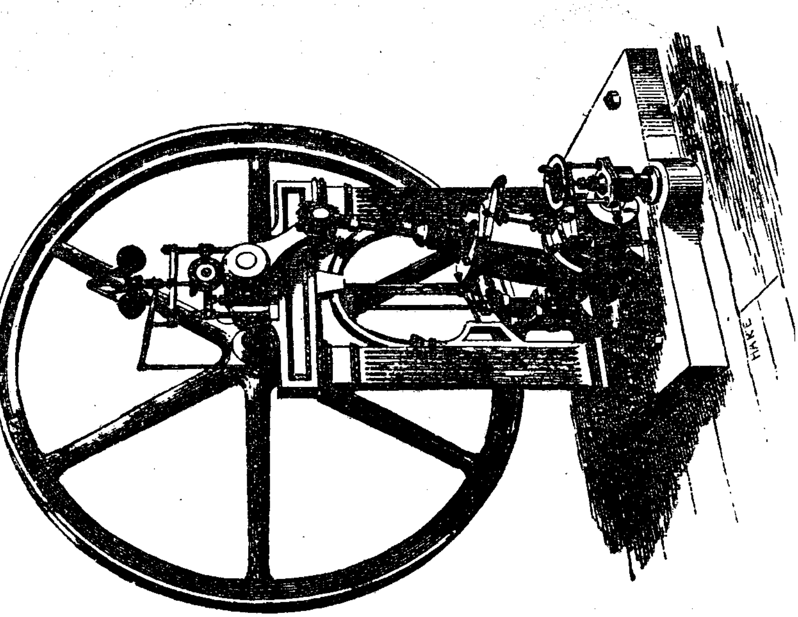


Fig. 39. Another "architectural" engine, by Clayton & Shuttleworth: note the curved slide for operating the rocker-arm of the valve-gear. The outer end of the crankshaft would be supported by a bearing built into the factory wall

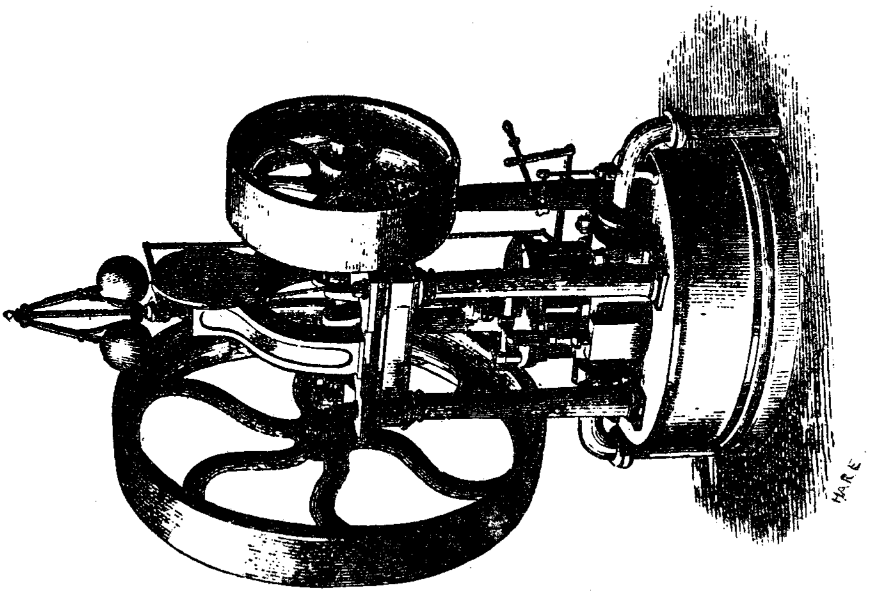


Fig. 40. Another oscillating engine, this time built by Crosskills, of Beverley

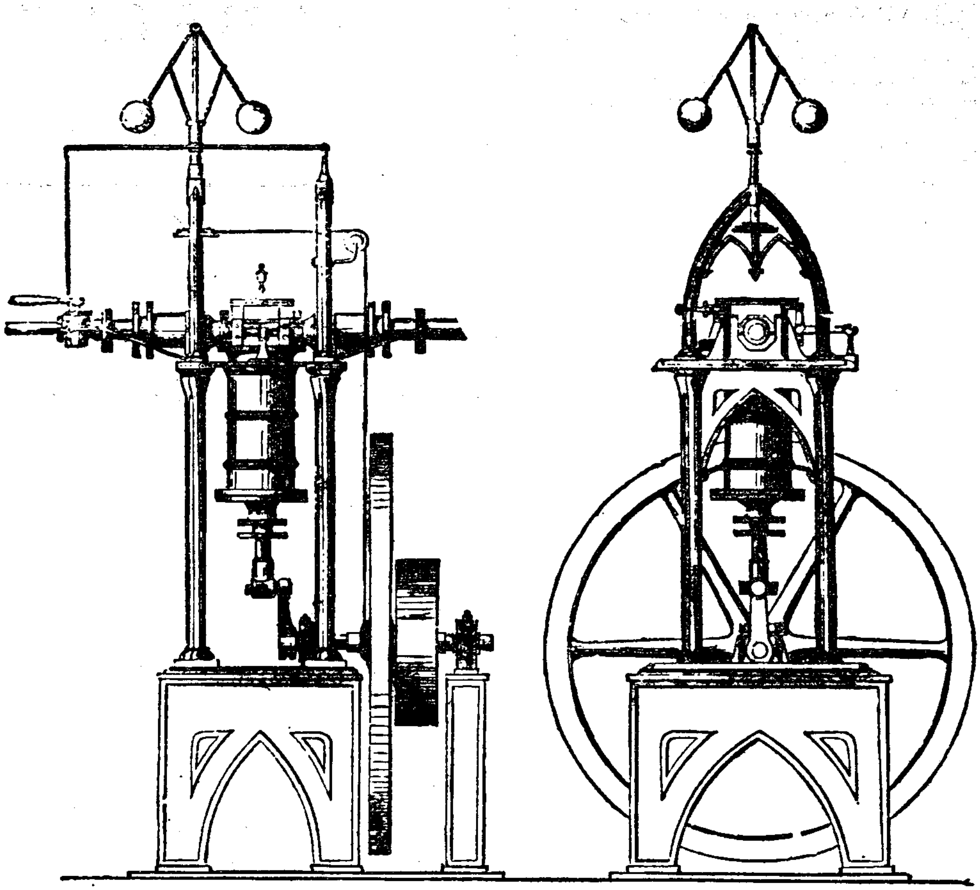


Fig. 41. *Joyce's pendulous engine, first built in* 1834, *was erected in large numbers, and at the Crystal Palace several examples were actually at work driving textile and other machinery*

the nearer trunnion on which the cylinder oscillates, and is controlled by a slide-valve in the circular steam-chest. The valve-rod is attached to an arm on a rocking-shaft, at the other end of which a similar crank carries a die-block working in the curved arm. Therefore, as the slide moves up or down, it works the valve correctly no matter how the cylinder oscillates.

A second eccentric drives the vertical water-pump, and a Watt-type governor controls a butterfly throttle-valve fitted between the main steam-valve in the foreground and the valve-chest. The exhaust steam passes through the belt cast on the cylinder, and out through the other trunnion.

A pretty engine which would make a nice uncommon model when we get back to our own century!

William Crosskill's steam-engine is also of the oscillating class, but with a rather different valve-gear, the steam-chest being mounted on the side of the cylinder (Fig. 40).

Joyce's "Pendulous Steam Engine" is another example of the oscillators, but with the steam-trunnions at the top of the inverted cylinder. As a matter of fact, these engines have been built since 1834, and we shall see quite a few of them actually at work in various parts of the exhibition, driving textile and other machinery, not forgetting Master's "ice-making machine" in the refreshment rooms.

Incidentally, the many steam-engines which are actually working throughout this vast building all take steam from well-lagged pipes passing under the flooring. These pipes obtain their supply from five boilers in a power-house at a little distance from the north-east corner of the building, and are fitted at intervals with globular water-traps from which the condensate can be emptied readily.

(*To be continued*)

"L.B.S.C.'s" Begin

Brake Gear for

HAVING built a little locomotive that will go, we might as well follow full-size practice and provide a means of stopping it, or preventing it accidentally moving from rest; and so we come to the final mechanical job, viz. the brake gear. Incidentally, it always amuses your humble servant when somebody or other starts to describe how to build an engine, and applies brake gear to the wheels as soon as ever they are on the frames, irrespective of whether the blessed thing will go or not. It reminds me of Mike O'Finnegan, who drives the Ballymacrackpot express, and always puts the brakes on before he starts, so as to make sure of stopping all right! Another reason why I left the brake gear to the last, was because it is optional; when *Tich* is on a little job of live passenger hauling, the brake on the passenger car will do all that is necessary in the way of stopping, the weight of the engine being far too small to have any appreciable effect in retardation (third programme again!). However, the provision of brake gear gives the finishing touch to the little "contractor's pug"; and for those who desire

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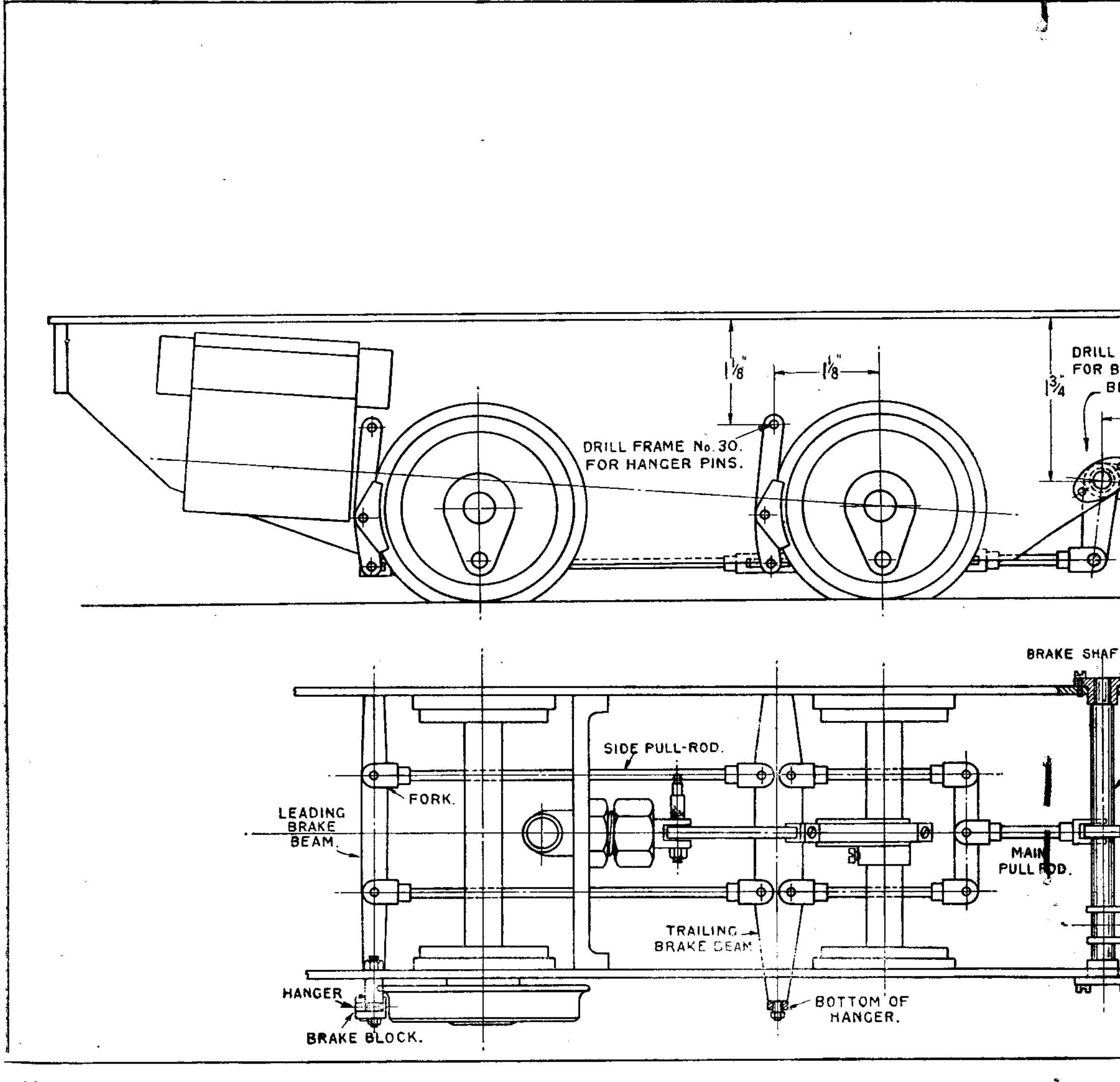
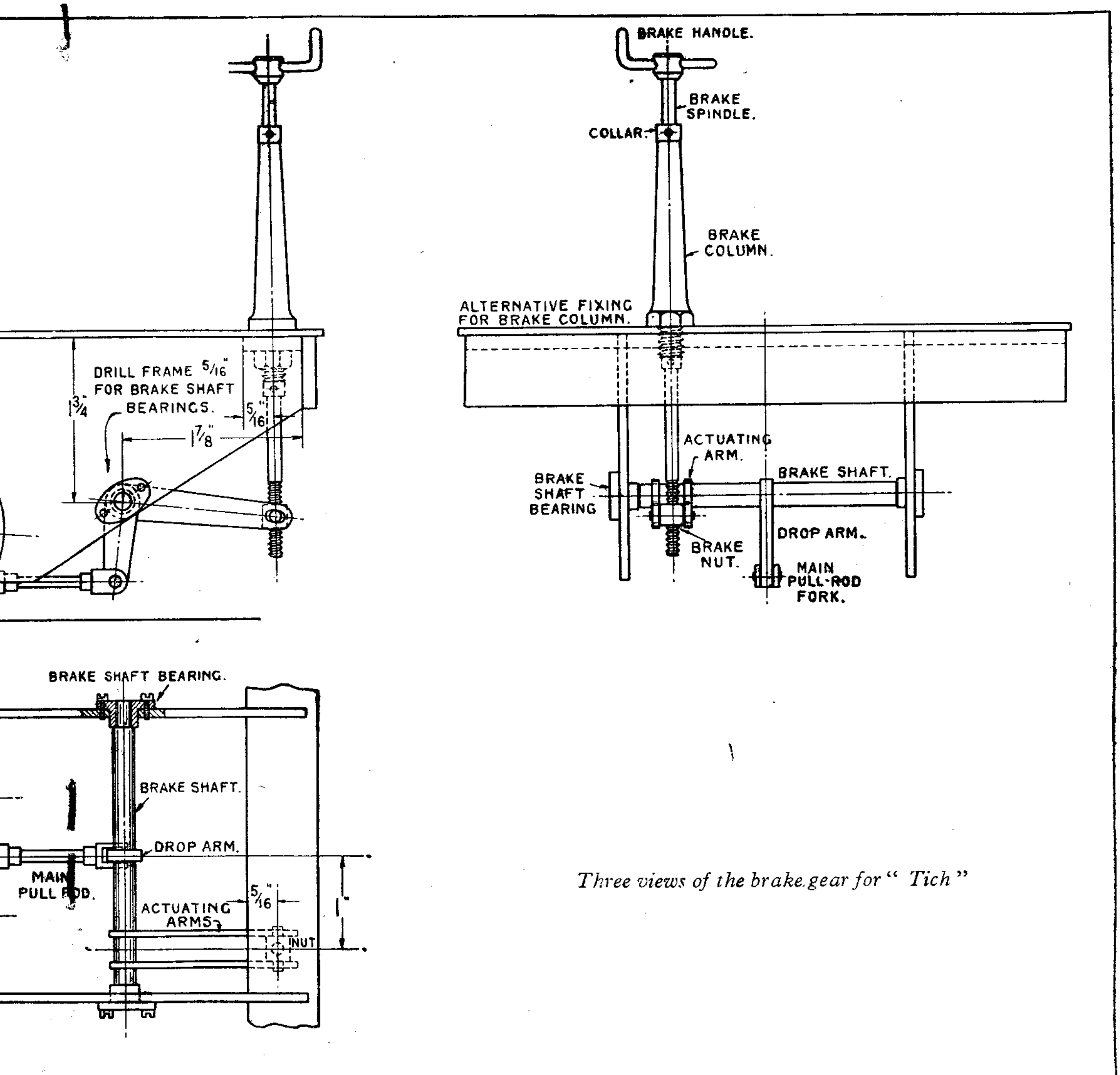


Beginners' Corner

ear for "Tich"

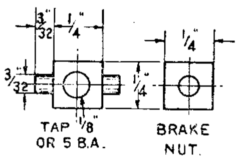
it, here are the necessary notes and illustrations.

At first sight it would appear that the brake rigging might be the "simplest ever," on a weeny four-wheeler; just blocks and hangers, with simple cross-beams operated by a single central pull rod connected to the drop arm on the brake shaft. Normally, this would suffice; but in the case of *Tich*, the low position of the axles, due to the little wheels, brings the pump down to a level that doesn't admit of a central pull-rod. On some full-sized locomotives having small wheels, and inside cylinders, the pull-rods are located outside the wheels, as on the old L.B. & S.C. Railway 0-6-0 goods tanks; but again, in the present case, the coupling-rods come too low, on the bottom centre, to allow of outside pull-rods being fitted. The only alternative is to use double pull-rods, arranging matters so that one comes at each side of the pump; and the plan view shows how this can easily be done. The leading and trailing beams are connected by two rods at $1\frac{1}{4}$ in. centres; the two shorter rods in line with them, are coupled at their front ends to the back edge of the trailing beam, and at the



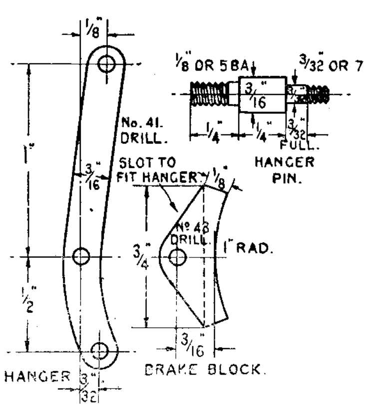
Three views of the brake gear for "Tich"

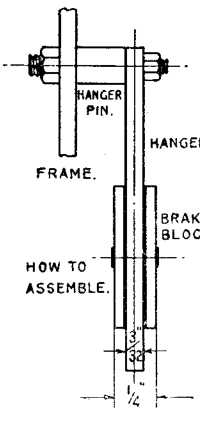
back ends to a connecting or equalising bar, which in turn is actuated by a single pull-rod coupled to the drop arm on the brake shaft. The latter is worked from the footplate, by the brake spindle, which is furnished at its upper end with the usual fireman's muscle-tester, and is supported by a column, screwed to the top of the rear buffer beam. It projects below the column, and is screwed to fit the brake nut. This is a tapped cube, with a pin projecting at each

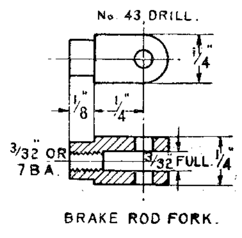


side, the pins working in slots in the ends of two parallel arms attached to the brake shaft. When the handle is turned, the nut moves either up or down, taking the parallel arms with it, and partially revolving the brake shaft, which is supported in bearings in the side frames. This causes the drop arm, situated in the middle of the shaft, to move forwards or backwards, according to which way the handle is turned; the movement causes the whole pull-rod assembly to move in unison, either applying or releasing the brakes as desired. Any beginner should be able to grasp the principles of action, in two wags of a dog's tail, by looking at the drawings.

As to the making and erecting of the various parts, this should not present the slightest difficulty to any beginner who has thus far completed the building of the little engine. There is only one bit that is at all likely to be ticklish, and that is erecting the leading brake hanger nicely between the cylinder casting and the leading wheel. There is just enough room for it; none to spare.







The First Step

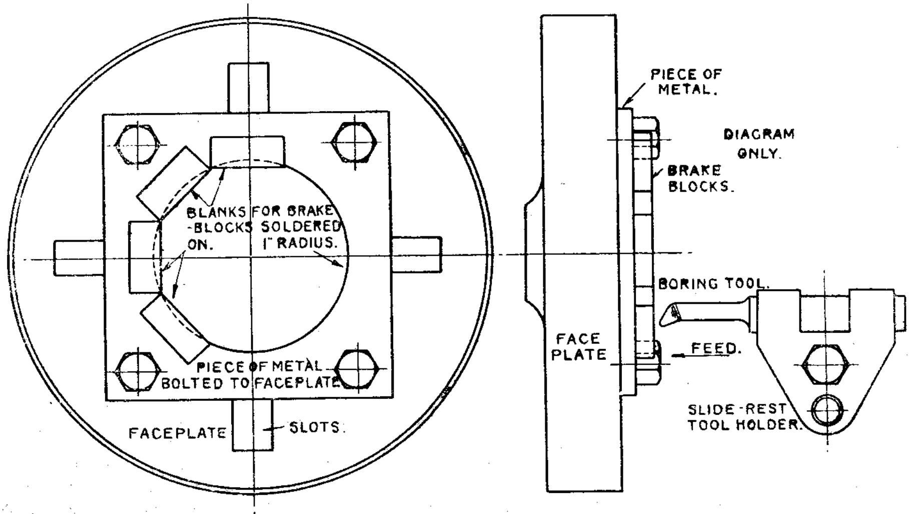
Item No. 1 is to locate the correct positions of the holes for the hanger pins in the main frames. They need not necessarily be "to mike measurements." though care should be taken to get them as nearly correct as is possible. However, the location is just "a piece of cake." The holes are $1\frac{1}{8}$ in. ahead of the axle centre, and $1\frac{1}{8}$ in. from the top of the frame. Now, as the edge of the wheel flange, at axle level, is $1\frac{1}{8}$ in. from the axle centre, all you have to do is to put your try-square with the stock resting on top of the frame, and the edge of the blade just touching the wheel flange; run your scriber along the edge of the blade, making a scratch on the frame. At $1\frac{1}{8}$ in. from the top of the frame, make a centre-dot on the scribed line, and drill it with No. 30 drill. Smooth off any burring. Nothing could be simpler!

To locate the holes for the brake-shaft bearings, apply your try-square, with the stock resting on top of the frame again, and the edge of the blade at $1\frac{7}{8}$ in. from the rear end of the frame, inside the buffer beam. Run your scriber along the edge of the blade, as before; mark off a point on the resulting line, at $1\frac{3}{4}$ in. from the top of frame. Centre-dot it, drill a No. 30 pilot hole, and open out to $\frac{5}{16}$ in., removing any burrs left by the drill. Ditto repeato operations on the other side of the frames.

Brake Blocks

Our approved advertisers might possibly be able to supply weeny cast-iron brake blocks, same as used on full-sized locomotives; if so, very little machining will be needed. The big ones are merely drilled for the pins holding them to the hangers; if the little blocks are clean, they won't need any more attention, unless the slot at the back, which fits on the hanger, needs cleaning out, in which case a thin flat file will do the needful. If, however, castings are not available, the blocks can easily be made from four pieces of $\frac{1}{4}$ in. $\times$ $\frac{5}{16}$ in. mild-steel rod, each $\frac{3}{4}$ in. long. The easiest way to cut them, is to chuck a length of rod of the given size, in the four-jaw (it doesn't matter about setting it to run exactly true) and part them off to the given length; otherwise, they may just be sawn off. If the latter, smooth off any roughness left by the sawing, with a file. The next item needed is a piece of metal about $\frac{1}{8}$ in. thick; I have shown a nicely-squared piece in the drawing, but that is only to make a pretty picture! As long as the bit of metal is big enough to carry the four blocks, and allow for two attaching bolts, it will do. Scribe a circle,

or part of a circle, on the metal, with your divider points set at 1 in. apart; lay the four embryo brake blocks on it, with their ends just touching the scribed circle, or part thereof, as the legal fraternity would say, and solder them to the plate. Drill two or more ¼ in. clearing holes in the plate, and bolt it to the lathe faceplate by ¼-in. bolts, as shown. The scribed circle, or segment of same, must be 1 in. from the lathe centre line. Set it either to the tip of a pointed tool in the slide-rest tool-holder, adjusted so as to be 1 in. from centre; or else stand a scribing block on the lathe bed, with its needle set to 1 in. from lathe centre, and adjust the piece of metal on the faceplate, until it lines up with the scribing-block needle; then tighten the bolts.



How to machine brake blocks

Put a boring tool in the slide-rest tool-holder, as shown in the diagram. This should have a fairly narrow tip, slightly rounded, as shown; alternatively, a knife tool might be used, set crosswise in the rest in similar fashion. In that case, it should be slightly above centre height, or else have extra clearance below the cutting edge, so that it doesn't rub on the blocks when cutting the radius. The point should also be inclined a little toward the operator. Run the lathe at a slow speed, feed the tool in just the same way as if you were boring a cylinder, don't forget a brushful of cutting oil, and you'll soon have a lovely radius on all the four blocks. Careful feeding is obviously essential; if the block bangs up against the cutting edge, through too "greedy" a cut being attempted, either the block will be knocked off the plate (unofficial history tells us that it was a turner who first used the expression "knock his block off"!) or else the tip of the tool will go west. Continue feeding until the tool cuts a small groove in the plate, and clears the edges of the blocks; then unship the plate and melt the blocks off it, wiping off any superfluous solder whilst still melted.

On the centre-line of each block, at $\frac{3}{16}$ in. from the curved edge, drill a No. 43 hole. If you haven't a drilling machine, use the lathe, with the drill in three-jaw, and the work held against a drilling pad in the tailstock barrel, or against a piece of hard wood across the end of it. The holes must be square with the sides of the blocks. Then go ahead and file all the blocks to the shape shown; a job needing more elbow-grease than instruction. If you happen to be the lucky owner of a milling-machine, shaper, or planer, put the slots in the back of the brake blocks before trimming the ends to shape. Hold them endwise in the machine-vice on the table of the machine. If milling, use a 3/32-in. saw-type slotting cutter on the arbor; one traverse, with the table set at the correct height to cut the depth of of slot required, viz. approximately ¼ in. will do the trick. The job can be done in the lathe, in similar fashion; I have already fully described the process in connection with other milling jobs. The block is held in a machine-vice, either a regular one, or an improvisation made from two bits of angle connected by bolts (also previously described and illustrated) which is bolted to the lathe saddle. The block is set at correct height, and slotted by traversing under a saw-type cutter on an arbor or mandrel between centres. No cutting oil is needed for cast-iron, but the steel blocks need a good dose for a clean finish; run the lathe slowly. After cutting the grooves, trim off the ends of the blocks at right-angles to the curved face, as shown in the drawing.

Brake Hangers

There are two ways of making the hangers; they may be made from strip steel of the correct section, and bent to shape, or cut out from steel sheet. Curved hangers are necessary, on account of the limited clearance between the backs of the cylinders, and the leading wheels. It would, of course, be possible to use straight hangers

for the driving-wheel blocks only, but this would be a cock-eyed sort of antic, necessitating separate measurements for erection, and not the slightest gain in efficiency.

The Strip Job.

For this, four pieces of 3/32 in. × $\frac{3}{16}$ in. mild-steel, a little over $1\frac{3}{4}$ in. long, will be required. Grip one of these edgewise in the bench vice, with about 1 in. length between the jaws, the remainder projecting from the end of them. With a lead or copper hammer, the projecting end can be judiciously coaxed into the shape shown in the illustration. If the metal buckles at the start of the bend, as it may do if you hit too hard, just take it out of the vice and flatten it; and before having another go, heat it to medium red and let it cool naturally. When you have one correct, use it as a gauge to bend the rest of the merchants to the same curve. They can then be marked out, drilled, and the ends rounded off, in exactly the same way as described for valve gear components. Mark out one only, drill it, and use as a jig to drill the other three, which not only saves time, but ensures that they are all alike.

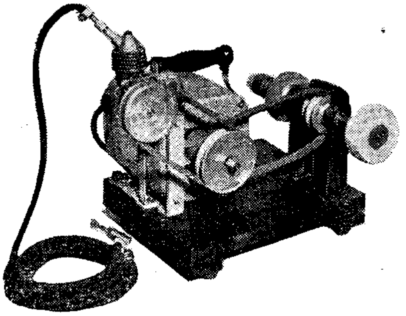
If you have any odd bits of steel left over from the frames, the hangers can be cut from them, and no bending will be required; just mark the shape of the hangers on the bits of steel, and saw and file to outline, leaving them a little on the big side (says Pat). Drill one, and use it as a jig to drill the others; then rivet them all together temporarily, and finish the lot to correct outline and dimensions, at one fell swoop. After parting, rub each on a bit of emery-cloth laid on the bench, to remove edge burring and put a bit of a finish on them.

The pins which carry the hangers are just a kiddy's practice job. Chuck a bit of $\frac{3}{16}$ in. round mild-steel in the three-jaw; face the end, turn down $\frac{1}{4}$ in. length to $\frac{1}{8}$ in. diameter, and screw $\frac{1}{8}$ in. or 5 B.A. Part off a full $\frac{7}{16}$ in. from the shoulder. Turn down a full $\frac{3}{16}$ in. of the other end, to 3/32 in. diameter; slip one of the hangers over it, and run a 3/32 in. or 7 B.A. die on until it almost touches the hanger. This will ensure that when the nut is screwed on as far as it will go, the hanger will still be able to move back and forth, without being subject to an attack of side wobblitis.

How to Assemble and Erect

Put the hangers in the grooves in the brake blocks, and test for movement with a bit of 3/32 in. round steel or wire filed to an easy fit in the hole. The block should tilt just a weeny bit each side of centre; just enough to allow it to accommodate itself to the wheel tread when erected, and when the brakes are on. When O.K., drive a bit of 3/32 in. steel clean through the lot, and file off to leave about 1/64 in. projecting at each side of the brake block, leaving the block just free enough to seat full length on the wheel tread, but not loose enough to lop over and rub on the tread when the engine is running. Then all you have to do, to erect, is to poke the $\frac{1}{8}$ in. ends of the hanger pins through the holes in the frames, and put nuts on the inside of same; put the hangers on the pins, and secure with ordinary commercial nuts. Next stage, operating gear.

A Compressor for the Home Workshop



A SPLENDID portable outfit comprising a $\frac{1}{4}$-h.p. a.c. motor, compressor, 13 ft. of air line with valve connector, and attachment for drilling, grinding and buffing is being produced by the Overseas Engineering Co. Ltd., 194-200, Bishopsgate, London, E.C.2, at a market price of £15 2s. 6d. net, or minus the attachment for drilling, grinding and buffing, £11 11s., delivery free in U.K. in returnable cases.

The motor is of the induction type, brushless, and, therefore, free of wireless and television interference. The compressor unit is of the Mopal type, which was designed for mounting on cars. It is efficient and durable in design, fitted with Cord piston rings and Oilite self-lubricating bearings. Its productive capacity is $1\frac{1}{2}$ cu. ft. per minute at 70 lb. per sq. in., a figure which will be found entirely adequate for paint spraying, the testing of small motors, pumps, tyre inflation, etc., etc. A service exchange for the compressor is in operation, the replacement costing only 9s. 6d.

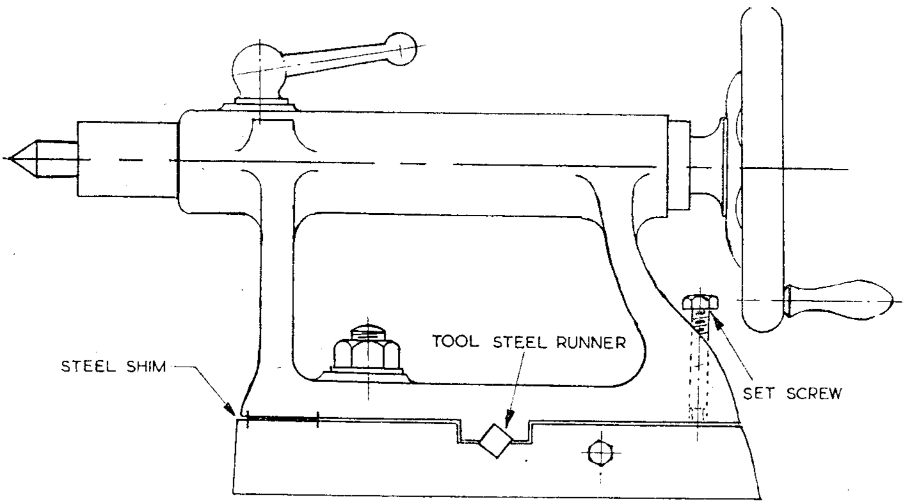
In addition to those already mentioned, the following accessories are also available for use with these units:—

	£	s.	d.
Pressure gauge fitted on airline ..	1	10	0
Spray gun	3	0	0
Tank complete with safety-valve and gauge	6	10	0
6-in. circular saw		12	0

The model we inspected was nicely made and finished, and would undoubtedly prove a useful asset in any home workshop. Further details may be obtained on application to the manufacturers at the above address, or telephone BIShopsgate 9878.

LATHE TAILSTOCK ALIGNMENT

by F. BUTLER



THE effect of wear and tear of the tailstock assembly of a lathe affects the accuracy of the finished product in several different ways. Wear on the bed-ways or tailstock soleplate lowers the effective centre height and results in the production of tapered work, the rate of taper being dependent on the work diameter and length. On flat-bed lathes in which the parallel central slot serves to align the movable headstock through the medium of a parallel gib-piece fixed under the soleplate and sliding between the bed-ways, there is normally no provision for adjustment, and in time the tailstock barrel becomes capable of some small angular movement which can result in the production of inaccurate work. Worse still, the errors are not consistent and it becomes necessary to make trial cuts before they become evident.

Further inaccuracies owe their origin to the set-over device employed for taper turning. They arise because of slackness between the soleplate and the upper portion of the tailstock assembly. Still another source of error is due to the barrel locking mechanism. Usually the basic design is rather poor, the clamping forces give rise to eccentric stresses and the axis of the spindle is often swung out of alignment with the principal axis of the lathe.

In lathes with American-pattern V-beds, wear results only in a small reduction in the effective centre height while the axial alignment remains undisturbed, but the errors due to the set-over mechanism are just as serious as in other types of machine. The present note describes some work undertaken to correct serious inaccuracy in a 6-in. centre lathe. Before starting on this operation, the fixed headstock had been completely overhauled, a new mandrel fitted and the main bearings had been re-bored. Chucking operations showed that a 4-in. test-piece could be turned parallel within 0.0003 in. Similar small errors were present in deep bored holes. It proved impossible to better these figures without employing a dangerously small clearance between the main spindle and the split gunmetal bushes.

Returning to the tailstock modifications, it will be seen from the diagram that the worn rectangular tenon under the tailstock is no longer employed to constrain the motion of this part while it is being set over. Instead, a short length of square-section machined tool-steel is fitted into V-grooves cut into the upper and lower components of the assembly. To correct for the small reduction in centre height, already mentioned, a slip of hardened shim-steel sheet is employed to pack up the front end of the tailstock. At the handwheel end, a set-screw adjustment is provided, and serves to remove any tendency for the upper component to rock on the edges of the tool-steel bar, and it also provides additional support which prevents the tailstock centre lifting appreciably under heavy cutting stresses.

Before undertaking any of the work of alignment, the existing tailstock spindle was removed and the bored hole in the main casting lapped out parallel throughout its length. An expanding cast-iron lap was used, driven from the lathe headstock. A new spindle was then machined from a nickel alloy-steel forging and fitted tightly into the lapped bore.

The two V-grooves were then finished to size,

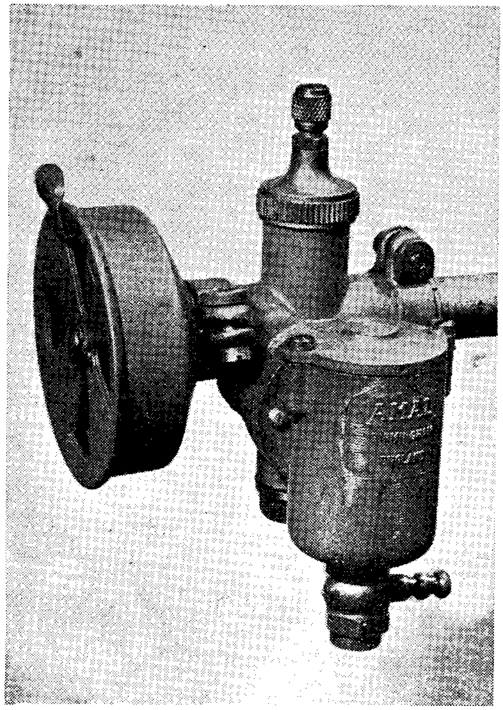
(*Continued on page 152*)

PETROL ENGINE TOPICS

*A 50-c.c. Auxiliary Engine

by Edgar T. Westbury

IN an engine employed for propelling a cycle, it is very desirable to provide some means of releasing the compression, and in the past, it has usually been found worth while to incorporate this as a separate engine control, operating either a small poppet valve in the cylinder-head in the case of a two-stroke engine, or an exhaust valve lifting device in a four-stroke ; in a few cases the operation was performed more scientifically by means of a " half-compression " cam on the camshaft. Modern motor-cycle engines, however, usually dispense with this provision, as it is rendered unnecessary when a clutch and gearbox are provided, but many motor-cyclists will remember how indispensable was this control in the days of fixed single-ratio transmission.



The Amal, type 308, *carburettor suitable for engines of* 50 *c.c. capacity*

Now that the latter has returned, in the case of the motor-assisted cycle, it is found that the provision of a compression release valve, or " decompressor," again becomes very desirable, to say the least. It is true that some of the engines commercially produced for this purpose have not been so equipped, but they have often been somewhat difficult to start from rest, and when shutting down, are unable to coast gently and smoothly to a standstill, but tend to stop with a jerk. This, of course, assumes that the engine has a reasonably good compression ; in quite a few, however, the fit of the piston is so poor that the absence of a decompressor would hardly be noticed !

Although the decompressor is a simple and apparently straightforward device, both its design and construction call for considerable care, and some types have been found in practice to give a good deal of trouble. It is not the simplest of all jobs to keep a small valve permanently airtight, while capable of easy operation at any time ; and either a leaky or sticky valve can be not only a nuisance, but also cause considerable loss of engine efficiency.

I have made experiments with several types of decompressor valves, mostly in connection with methods of operation, the valve itself being of the spring-loaded mushroom type, but with variations in the means provided for opening it. These have included levers of the first and second order, and also bell cranks, all of which have worked quite satisfactorily, but have been open to criticism as being unnecessarily complicated and often unsightly. The lever of the decompressor, shown in photograph on page 413 of the March 29th issue, is a case in point ; it works quite well, but can hardly be said to look like an efficient device.

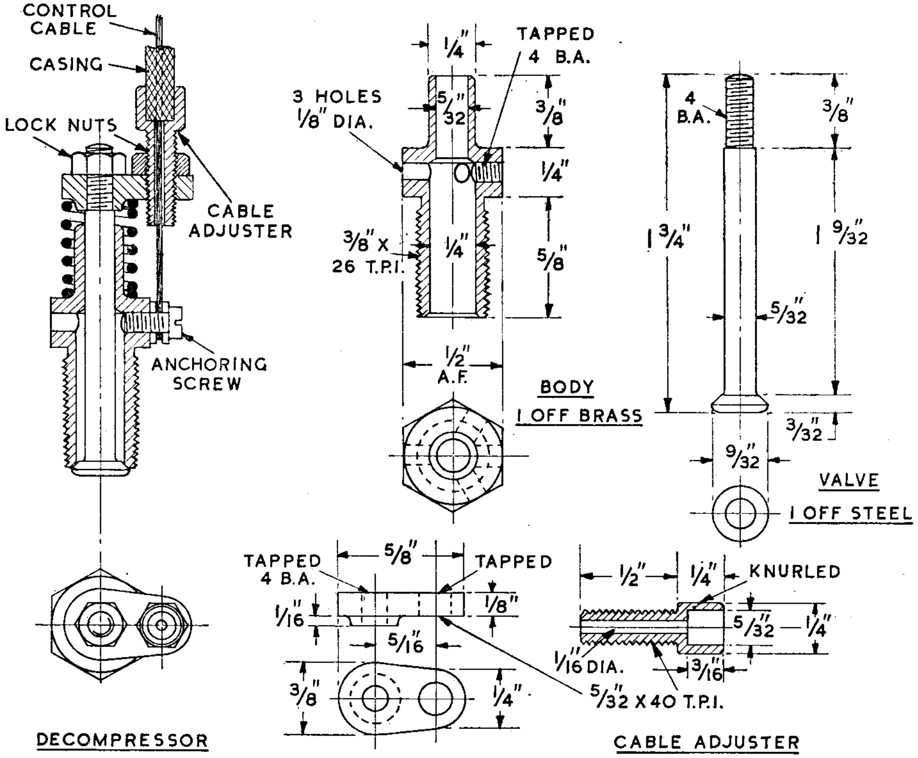
As usual in such cases, it has been found that the simplest method of operating the valve has been the most successful in practice, and I have therefore dispensed with the use of levers, and adopted a method of direct operation, as shown in the drawings. It will be seen that the valve stem is provided with a thrust plate which carries an adjusting nipple having a socket to take the casing of the Bowden control cable. The inner cable is anchored to the body of the valve. Although this method introduces a certain amount of side thrust, due to the pull being offset from the valve centre, it has proved quite successful in practice, so long as the offset is not excessive.

In most commercial applications of the decompressor to two-stroke engines, it is usual to connect the escape port of the valve to the

*Continued from page 80, " M.E.," July 19, 1951.

exhaust pipe, with the two-fold object of silencing the hiss of air escaping from the valve, and also carrying away oil spray. This has not been done in the present case, but it would be possible to make a slight modification in the design so as to enable a banjo union and escape pipe to be fitted, to lead into the exhaust pipe or silencer.

With regard to the control lever for the decompressor, this can, if desired, be incorporated in the dual type of carburettor control as fitted to be at all difficult if the work is run at high speed, deeply centred, and both the drilling and counterboring carried out with sharp drills. A 5/32-in. reamer or D-bit should be used to finish the bore of the guide. At the same setting, a small boring tool should be used, with the top-slide set over to 45 deg., to produce the slight chamfer (not more than 1/32 in. wide) which forms the valve seating. This could, perhaps, be carried out more simply with a countersinking cutter,



BODY
1 OFF BRASS

VALVE
1 OFF STEEL

DECOMPRESSOR ASSEMBLY

THRUST PLATE. 1 OFF M.S.

CABLE ADJUSTER
1 OFF M.S.

the older types of motor-cycles, but the usual method nowadays is to employ a single lever having a double action, one direction to open he carburettor throttle and the other to open he decompressor. A lever of this type is provided for the Amal type 308 carburettor, and it is also possible to obtain double-acting twist-grip controls on the same principle.

Decompressor Construction

The body of the valve should preferably be made of hexagonal brass, ½ in. diameter across flats, though steel is permissible, and may be more durable if the valve is made of a harder material. A departure from hexagonal section is also in order, so long as means can be provided for screwing the body firmly into the head.

The most important point in machining is to ensure that the bores of the guide and seating are concentrically aligned, and this should not but there is a risk of producing a chatter or wave in the surface which would be more trouble than it is worth to put right afterwards.

After turning down and screwing the outside (don't forget the undercut just sufficiently deep, and no more, to enable the body to screw right home in the head), it should be reversed and held in a tapped piece of stock to turn the top end, which is not of critical importance in respect of truth with the bore. The three escape ports are then drilled in alternate flats of the hexagon, and a fourth hole drilled and tapped 4 B.A. for the anchoring screw.

The valve may with advantage be machined from the stem of an old motor car valve, or from a high-tensile aircraft bolt. If these are unobtainable, mild-steel is permissible, but should not be used if the body is of the same material. It is possible to machine all essential surfaces at the same setting, with the work held in the chuck, and part off when finished. If the

screwed end is turned to size first, it may be supported in a hollow centre while machining the main diameter, which should be dead parallel, well finished, and a good fit in the bore of the guide. Set the top-slide over to 45 deg. to finish the seating. After parting off, the valve stem may be held in a shim of metal foil for cleaning up the head. A slot may be cut across the head to take a screwdriver for grinding in, but very little of this treatment is either necessary or desirable ; I find it sufficient to twirl the other end of the valve between thumb and finger, using a little brick dust or Vim as an abrasive.

To make the thrust plate, a piece of round steel bar about $\frac{7}{8}$ in. diameter may be used ; this is held in the chuck, faced, drilled and tapped 4 B.A., and a slight boss turned to locate the spring. It is then parted off and cleaned up on the top surface, after which the hole for the nipple is drilled and tapped $\frac{5}{16}$ in. off centre, and the unwanted metal cut away. This will be found easier and quicker than making the plate from flat or rectangular bar of more approximately correct initial shape.

The cable adjusting nipple is of the type very commonly used on Bowden cable fittings, and therefore calls for little comment. It will be found worth while to make this of mild-steel, which is more durable than brass, though the latter is often used for the sake of easy production. The recess in the head should form a close-fitting socket for the cable casing, and a hole giving free clearance for the inner cable is drilled right through.

When assembling the components, a spring strong enough to seat the valve positively and firmly should be fitted. Readers often expect me to give exact specifications of springs referred to in these articles, but that is not so easy as it sounds. The strength of a spring is not necessarily dependent entirely on the gauge of wire, number of turns, and diameter of the coil, as the elasticity of different spring materials varies within wide limits. Even in commercial practice, spring design is often tentative and experimental, and I know of many cases where several different springs have had to be tried before the desired result is achieved. In the present case, I suggest that a spring of about 20 gauge piano wire (without subsequent tempering), about $\frac{1}{4}$ in. internal diameter, and having six complete turns, excluding flattened end turns, will be about correct. The ends of the spring should be ground square with the axis, and the free length should be not less than $\frac{5}{8}$ in.

As the end of the cable does not have to be fitted with a soldered nipple, it is not necessary to slot the thrust plate to get the cable in ; all that is required, after fitting the nipple and inserting the cable, is to bend the end of the latter into a tight loop with round-nose pliers and clamp it to the body with an ordinary 4 B.A. steel screw and a couple of washers. If subsequent shortening of the cable is found necessary, beyond the amount provided by the adjusting nipple, a new loop can be made and clamped again as before. By the way, I presume readers to have some knowledge of fitting cable controls, and if so, they will know that the cable ends should always be soldered to keep the strands together while fitting.

(*To be continued*)

LATHE TAILSTOCK ALIGNMENT

(*Continued from page* 149)

the bulk of metal being removed by drilling, sawing, chipping and filing. As the finished size was approached, periodic checks were made with a dial indicator, care being taken to keep the centre height safely above the nominal figure of 6 in. When it became evident that the final adjustment could be made by scraping to size, the measuring technique was changed. A dial indicator was clamped to a small faceplate on the lathe headstock spindle. The tailstock was then moved along the bed until the indicator plunger came into contact with the outside of the barrel. Hand rotation of the lathe spindle pulls the indicator round the end of the tailstock spindle in a planetary motion. The object to be attained is to ensure that, during one entire revolution, the indicator reading remains quite steady.

This particular operation was first performed with the tailstock barrel fully retracted and then repeated with the spindle projecting about 3 in. A succession of tedious adjustments were required before identical indicator readings were observed in the two cases. After each scraping process, all the dimensions were altered. Extreme caution was required in the final stages of the adjustment. It was then found that, by tightening the clamping set-screw at the end of the tailstock, there was sufficient spring in the castings to cause a slight vertical movement of the end of the tailstock spindle, amounting to about 0.002 in. This fault seemed unavoidable, but it causes negligible errors in plain turning, since there is no appreciable lateral motion of the spindle. All indicator readings were made with the tailstock barrel tightly locked.

It is clear that the standard design of this part of the lathe is open to a great deal of criticism, and the same inherent faults are often present in modern tool-room lathes. From the point of view of the model engineer, a complete redesign should be worth considering by some enterprising manufacturer. If the soleplate was constructed in the form of a long and rigid cross-slide and if the tailstock spindle was made of heavy square-section bar, capable of being clamped in two places along its length, a wide range of milling operations could be undertaken with the aid of simple attachments. Other accessories would convert the unit into a useful capstan head. Additional fittings could be provided for slotting, keyway cutting and internal grinding operations.

A PROPELLER TESTING TANK

by D. H. CHADDOCK

SINCE Mr. L. V. Raxworthy, on behalf of the North London Society of Model Engineers, has asked for suggestions or criticisms of the Propeller Testing Tank described in THE MODEL ENGINEER on page 698 of the last volume, I hope that my remarks will be taken as wholly constructive and coming from one intensely interested in the testing of all aspects of models.

First, I think it is a pity that the apparatus was arranged to give comparative and not absolute readings. The difference is subtle but a very real one, since all research and experimental work should, if possible, be expressed in the fundamental units of pounds, feet and seconds. How, for instance, can one calculate the *actual* thrust of a propeller from the readings of the manometer gauge and how is this related to a certain load on the damper-plate ? Is the speed of the propeller measured or is it assumed that on each notch the driving motor runs at the same speed regardless of the load imposed by the propeller and the friction losses in the chain drive ?

Probably the biggest drawback of the device is that the propeller is operating under nearly stalled conditions, and that the measurements are more concerned with the strength of the slip stream that it is endeavouring to create than its ability to produce thrust when moving forward into solid water—the "*modus vivendi*" of a normal propeller

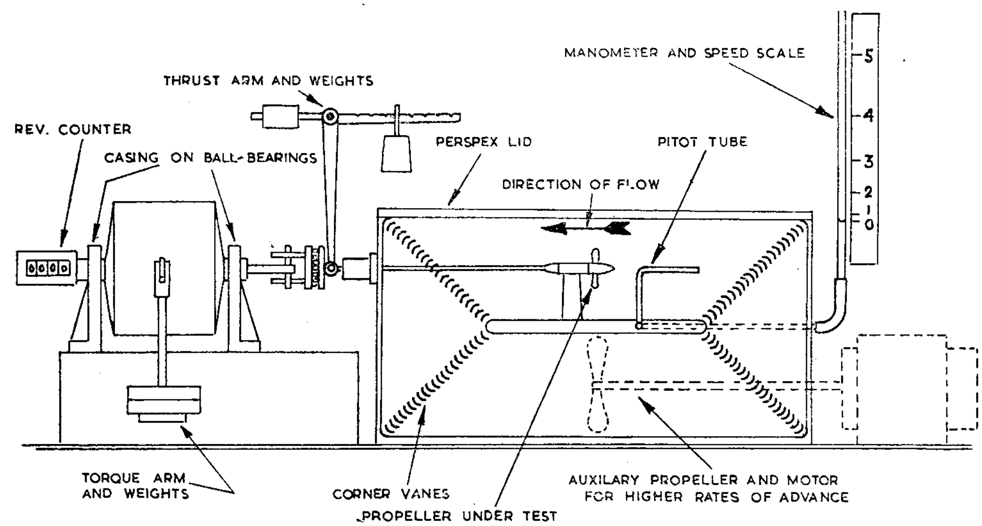
Having made these sweeping criticisms it is up to me to show how they might have been avoided in an apparatus no more complicated to construct.

First, by arranging the motor co-axial with the propeller shaft, the unknown losses in the chain drive could have been avoided. By mounting the motor frame on ball-bearings co-axial with the shaft and arranging a torque arm in the manner of an electric dynamometer, the driving torque could have easily been measured. A simple revolution counter mounted on the motor frame and a stop-watch would enable the speed to be measured, and with speed and torque the horse-power input to the propeller is easily calculated. In fact, if the torque arm is 6.3 in. long, then the load in lb. on the arm, multiplied by the speed in revs. per min. divided by 10,000 is the horse-power.

Secondly, by driving the propeller-shaft through a two-pin coupling, as often used in model marine installations, and giving the shaft plenty of end float, the actual thrust of the propeller could have been taken on a thrust-collar and bell-crank weighing arrangement no more complicated than that used with the damper plate. This would have given a direct reading and with thrust in lb. speed in revs per min. and horse-power input in horsepower, one is beginning to get somewhere and has far more useful information than relative manometer or damper plate readings.

The third requirement of allowing the propeller to advance at a known speed of propulsion through undisturbed water is harder to achieve, even in full-size propeller testing tanks. The very fact that the propeller is operating in a relatively narrow channel instead of in open water makes a difference, and eddies in the return flow are very hard to damp out completely. A large channel

(*Continued on page* 156)



Schematic diagram of a proposed propeller testing tank

Novices' Corner

Keyway Cutting in the Lathe

CUTTING internal keyways in pulleys and gear wheels is so often required in the small workshop that the simple method of machining, here described, may prove useful to many less-experienced workers.

The ordinary form of shaft key and keyway is illustrated in Fig. 1, and, here, the flat, parallel key is made a firm fit in the shaft itself. The mating part, a flywheel, for example, is machined with a corresponding keyway to fit the key closely, but at the same time this keyway must be given a small clearance to enable the parts to be easily assembled.

Keyways can, of course, be cut with a file, but considerable skill is required to obtain an accurate fit. On the other hand, if the work is carried out in the lathe, there is little difficulty in cutting a parallel keyway true to size. When cutting a keyway by this method, the lathe is made to act as a small shaping machine ; that is to say, the work-piece is either mounted in the chuck or is secured to the lathe faceplate, and the cutting tool is moved to and fro by actuating the lathe saddle or top slide.

In addition, as will be described later, the lathe mandrel must be locked to keep the work from rotating and moving out of position.

It is proposed, therefore, to describe in detail the cutting of an internal keyway in a part with a parallel bore like the wheel hub illustrated in Fig. 1. When a tool of the correct shape is mounted at centre height in the lathe toolpost, and while in contact with the work is moved backwards and forwards by traversing the lathe saddle, it will be clear that, as represented in Fig. 2, a parallel groove will be cut in the bore.

Furthermore, both the length of the groove and its depth can be directly and accurately controlled by the movements of the lathe saddle and cross-slide. As shown in Figs. 2 and 3, the tool used for this purpose resembles a parting tool, but the fore part is made longer to enable the cutting edge to reach to the end of the keyway ; in addition, the sides of the blade behind the cutting edge must have enough relief to allow the tool to cut freely without rubbing against the walls of the groove.

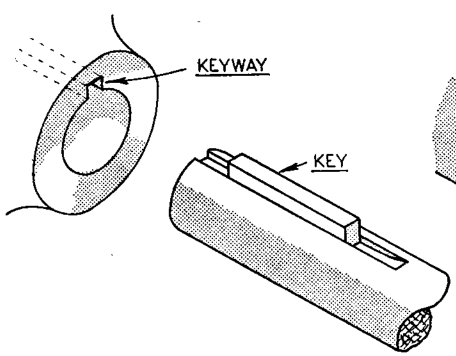


Fig. 1. Method of keying a wheel to a shaft

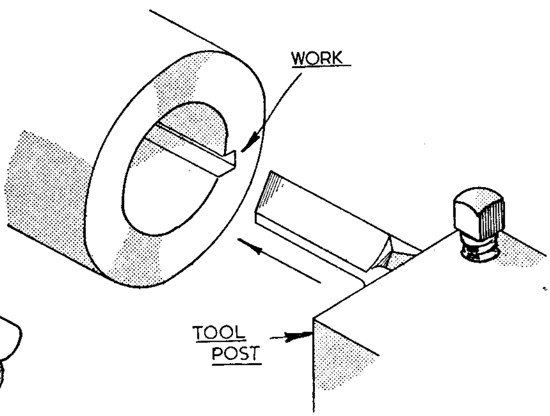


Fig. 2. Cutting a keyway in the lathe

The sectional drawing, Fig. 4A, shows what actually happens when the tool is cutting the keyway. It is, however, essential that at each forward stroke the cutting edge of the tool should pass right through the work, in order to separate the individual chips and so finish the far end of the keyway correctly to size.

Where the keyway has to be cut in a blind hole, as illustrated in Fig. 4B, a groove should be turned in the work to allow the tool to cut cleanly for the whole length of the keyway. This undercut groove can be readily machined with a square-ended boring tool, and the depth of the groove formed must be a little greater than the total depth of the keyway itself.

Making the Cutting Tool

The tool should be ground to the form illustrated in Fig. 3, but it is also important that the width of the cutting edge should match the width of the key, for, when the work is completed, the key should fit closely in the keyway. It might be thought that the width of the keyway could be adjusted during the machining operation by slightly rotating the work, but this would form a

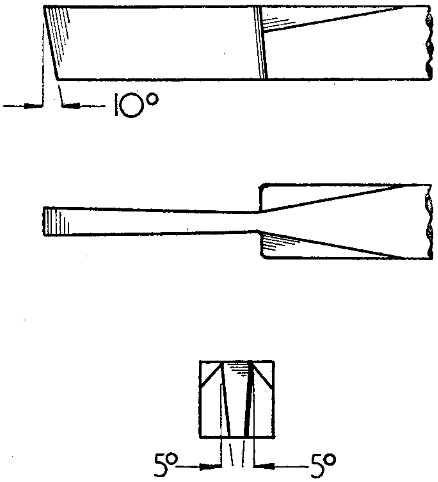


Fig. 3. Showing the form of cutting tool used

keyway with radial and not parallel sides; moreover, the width of the cut would be very difficult to control accurately. It is better, therefore, to rely on making the tool of the correct width to finish the keyway to size. This is done by measuring the width of the key with the micrometer and then grinding or honing the tool to correspond; if the tool is made of equal width, the key will fit firmly in the finished keyway, and an allowance of ½ thousandth of an inch in the width of the tool will give a sliding fit. To make sure that the key and the keyway are correctly in line so that the parts can fit together, the keyway must be cut exactly on the centre-line of the work, and the keyway is, therefore, best cut while the work is still in position after machining the bore. Furthermore, as represented in Fig. 5, the centre-line of the tool is marked-out with the jenny calipers, and this line is set to register with the point of the lathe mandrel centre. When the tool has been correctly adjusted and securely clamped in place, the lathe centre is removed and the chuck is replaced on the mandrel nose.

In Fig. 2 the cutting edge of the tool is shown turned away from the operator, for when the

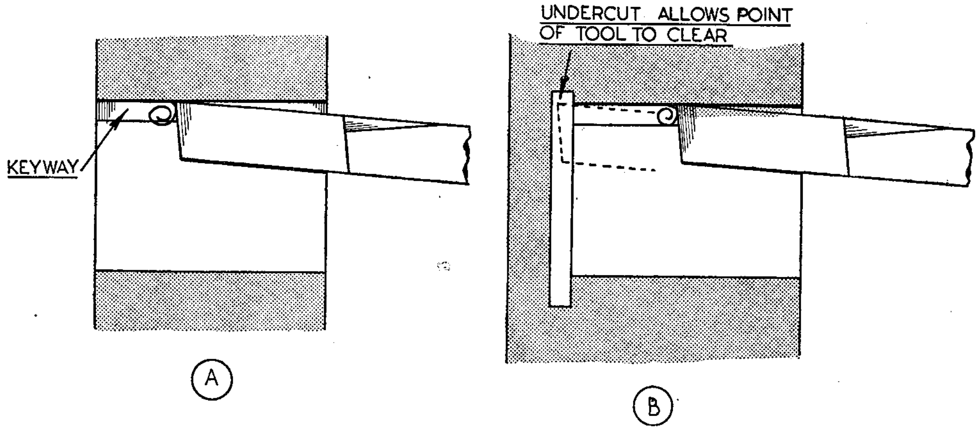


Fig. 4. "A"—the tool cutting a through keyway; "B"—method of providing end-clearance in a blind bore

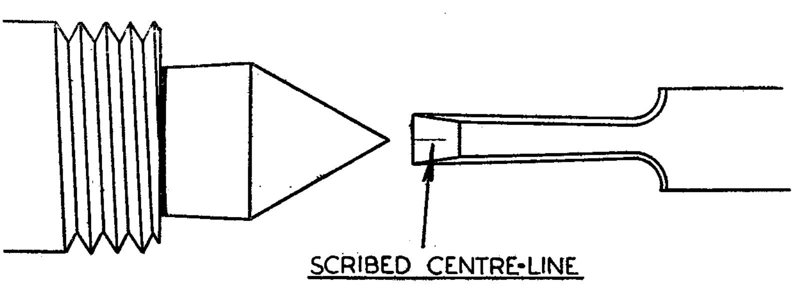


Fig. 5. Setting the tool to exact centre height

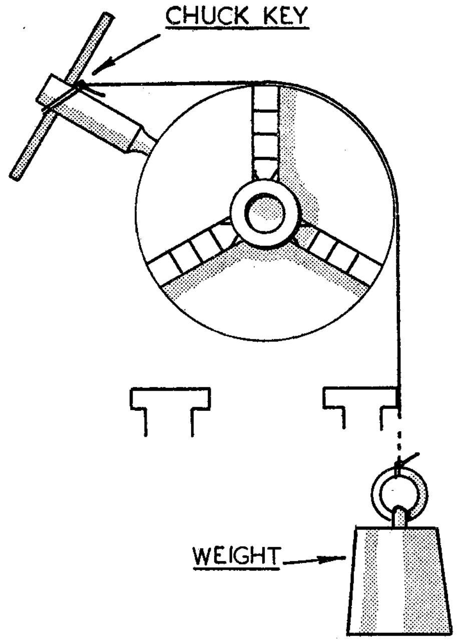


Fig. 6. Using a weight to take up the backlash in the backgear

tool is in this position the progress of the work can be more easily followed. Before the actual machining is started, the lathe mandrel must be locked with the tool in line with the marked-out position of the keyway.

Although engaging the backgear shaft without releasing the bullwheel lock will stop the mandrel turning, the backlash present will allow some movement of the work. In order, therefore, to eliminate this small amount of movement, a chuck key is inserted in the chuck and, as shown in Fig. 6, a length of cord with a weight attached is made fast to the key. If a moderately heavy weight is used, all backlash will be taken up and the work will be securely held against any side thrust set up by the tool.

A better way of locking the mandrel is to lock the bullwheel itself, for this wheel is firmly keyed to the mandrel. This is done by using a rigid detent to engage the wheel teeth, but the form of detent fitted will, of course, depend on the construction of the lathe. When machining the keyway by traversing the lathe saddle to and fro by means of the rack gear, only light cuts should be taken, and a cross-slide feed of some two thousandths of an inch for steel and four thousandths for brass should ensure free cutting. When the finished depth has been reached, the tool should be traversed backwards and forwards a few times, without altering the feed, in order to give a good surface finish to the keyway. The feed is adjusted before each forward stroke of the tool, and when machining steel, plenty of cutting oil should be used, but brass, bronze, and cast-iron are machined dry.

Since these notes were written, Mr. E. T. Westbury has, we see, advocated in a recent article this method of cutting a keyway in the crank disc of a petrol engine, which goes to show that the really experienced worker relies on simple, well-tried methods of machining.

A Propeller Testing Tank

(*Continued from page* 153)

in relation to the size of the propeller being tested with plenty of eddy damping is the best, but then it needs a large and powerful secondary propeller to set the mass of water in motion and keep it moving at the right speed.

For a simple model test, a return flow channel with guide vanes at the corners might give useful results, but the cross-sectional area of the channel, particularly on the return bends, must be several times greater than the area of the propeller disc, not two 1 in. diameter tubes which would be inadequate for all but the tiniest propellers. Unless a secondary and independently driven variable speed propeller is used in the return path, the speed of water flow in the channel is only partially under the control of the tester. It can be reduced by extra damping but cannot be increased above that set by the natural losses of the channel, which should, therefore, be kept as low as possible. In any case, the relative speed of advance can easily be measured by means of a forward facing sharp-edged tube (Pitot tube) and manometer. Mounted ahead of the propeller, not in the slip stream, it will give a reading of $v = \sqrt{2gh}$ where v is the velocity in ft./sec., g is 32.2 and h is the rise in feet of the manometer above the still-water level. As a speed of only 5 m.p.h. will give a rise of 10 in. water gauge, speed readings should be relatively easy to take.

The schematic diagram shows how the plant might be rearranged and if, as I sincerely hope, Mr. Raxworthy and his North London Society of Model Engineer colleagues decide to rebuild it this way, I am sure they will obtain much information of vital interest to model engineers.

Queries and Replies

Enquiries from readers, either on technical matters connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed : "Queries Dept.," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the service of an outside specialist or consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query ; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9927.—Adapting Plain Lathe to Screw-cutting

V.F. (Finchley)

Q.—Some time ago, I built myself a plain lathe, but now I want to convert it to screw-cutting. I have so far altered the bed and almost made a new saddle. I have a leadscrew given me, but it has 10 t.p.i., and I recollect reading in THE MODEL ENGINEER that the Drummond 4-in. lathe has a 10 t.p.i. leadscrew with change wheels in multiples of 4. Is this necessary, or can I use wheels that are multiples of 5 ? Can you also tell me the most suitable d.p. for the gears and the approximate shape of the banjo ? On many lathes the gear is changed on the mandrel, but that would be awkward, as it is $1\frac{1}{4}$ in. diameter. Would I need a wheel larger than 100 teeth for a fairly fine feed ? If this can be done, I would like to fit a tumbler reverse.

R.—The fitting of screwcutting gear to your plain lathe with a 10 t.p.i. leadscrew involves the use of a different range of wheels to that which is commonly used on small lathes, in order to cut standard pitches. This explains the reason why the change-wheels used in connection with a 10 t.p.i. leadscrew are in multiples of four. It is far more common nowadays to find leadscrews of 8 t.p.i. fitted to small lathes, as this enables wheels in multiples of five to be used. We suggest that a suitable pitch for the change-wheels would be 20 d.p., though coarser pitches than this up to about 14 d.p. have been used on many lathes in the past, but there does not appear to be any great advantages in this for normal purposes. The shape of the gear quadrant or banjo will depend very largely on the design of the lathe headstock. The gear ratios required for fairly fine feeds could be obtained either by using driven wheels having a large number of teeth, or by increasing the number of compound stages in the gear train. With reference to the matter of a tumbler reverse, we are of the opinion that you could obtain a complete tumbler reverse gear having 20 d.p. gears from the Myford Engineering Co., Neville Works, Beeston, Notts, who would probably be able also to supply an 8 t.p.i. leadscrew and full set of change wheels.

No. 9930.—Projector Mirrors

T.B.S. (Gateshead)

Q.—I have built myself a projector which optically is a duplicate of the Leitz VIIIs but with a 750 W lamp instead of a 370 W lamp. The original projection lens is used, but other lenses are copies of the Leitz and have been proved accurate. The trouble is that with the mirror in use, it is impossible to avoid an intensely brilliant spot focussed on the heat absorbing screen. Adjustments to the mirror merely alter the size of the spot, but do not eliminate it. Can you tell me how much light will be lost (approximate per cent.) if I discard the mirror, or, preferably, how I can get rid of the spot.

R.—The trouble with your projector mirror is that it is not of the correct focal length. In setting the focus of a concave mirror of this type, it is a very good idea to put a weak illuminant such as a flash bulb in the exact spot which is normally occupied by the lamp filament, and observe this through the objective lens tube with both objective and condenser removed. The mirror should then be adjusted so that it shows a reflection of the filament, either above or to one side of the lamp filament, and as close to it as possible. We cannot estimate how much light is likely to be lost if the mirror is not used, without knowing just what the optical efficiency of the mirror is, and even so, the efficiency of the arrangement varies with the particular arrangement of the filament.

No. 9928.—Protection of Engines under Sea-water

A.R. (Blackpool)

Q.—I intend to fit an engine in a 4 ft. odd tug boat which I have made. This is sailed in sea or salt water which attacks or oxidises aluminium, and I wish to use the sea-water for cooling. What would you suggest treating the inner parts with, also the outside. Is gold size of shellac varnish suitable?

R.—For protecting aluminium water jackets from the effects of sea-water, we suggest that a hard copal varnish or an enamel containing copal varnish would be the most suitable, though it is not usually desirable to use aluminium for the jackets of engines which have to run in sea-water, as complete protection cannot always be guaranteed, due to the possibility of the protective coating becoming scratched, or flaking off.

No. 9932.—Arc Welding by Car Battery

F. McC. (Falkirk)

Q.—A considerable number of small lengths of copper wire varying in diameter between 24 and 16 s.w.g. are required having leads on them similar to an ordinary pin but more globular in shape, the size not being critical. Having little or no knowledge of electrical work, I would be grateful if you could tell me if it would be possible to fuse copper wire of the above gauge by striking an arc with a carbon electrode, current supplied from a 12 V car battery? If so, would a particular sized carbon rod be necessary, and would the current taken be greater than that which would discharge the battery without damage? Can it be estimated, roughly, how many times such an arc can be struck sufficiently to fuse the end of the wire, from a 60 A-H battery, until recharging becomes necessary?

R.—Welding in the true sense cannot be carried out at voltages below 60. With the aid of a suitable carbon rod and source of a low voltage supply, it is possible to create a local amount of heat, but this is not welding. It is not possible to work an arc at the voltage you name. In any case, and if you wish to experiment with a low voltage battery, the accumulator should have a capacity of not less than 200 A.H. Your so-called arc will probably use at least 20-30 A. If you have a source of a.c. supply, the simplest procedure would be to use a transformer. For the purpose you have in mind, a voltage range between 12 and 20 would be suitable. By clamping the pins as close to the head as required by one of the electrodes, an ordinary carbon rod from a torch battery would be suitable for the heating electrode. Another way would be to use a carbon block as one electrode, and form your pin-head by pressing the pin on the block.

The transformer that will suit your purpose would be as follows:—the core would be made up having two limbs, each being 1½ in. × 1¼ in. and 3½ in. in length. This transformer can be built up from plain strip stampings. There will be two coils, one on each limb. Bobbins can be made for the coils from stout card or fibre. The primary will have 1,272 turns of 18 s.w.g. plain enamel covered copper wire. The secondary will have a maximum output of 30 V, 30 A. The secondary will be wound with 14 s.w.g. plain enamel covered wire or single cotton covered wire. The total turns will be 160. Taps are taken at 32, 64, 106 and 160 to provide voltages of 6, 12, 20 and 30. There may be some difficulty in obtaining stampings at the present time, but the surplus market should be tried for an old transformer. If you are unsuccessful, we suggest that you write to one of our advertisers who could probably supply one for your requirements.

No. 9929.—Cable and Earth for Motor Installation

H.M. (Falmouth)

Q.—I am installing a ¼ h.p. split phase induction motor in my workshop to drive a 3⅜-in. lathe. At present my current is carried by a length of 10/44 twin cable which I am told will carry a load of 5 A. The full load current of the motor is 1.5 A, but the starting load is six to eight times this amount, according to the makers. Would my cable be capable of carrying this load of up to 12 A during the starting period of the motor. I intend earthing the motor by means of a copper tube driven into the ground outside the workshop. Will this arrangement be satisfactory?

R.—We are of the opinion that the cable you are using would be suitable to carry the surge current of a ¼ h.p. induction motor. It is, however, always advisable to err on the large side when installing cables, as there is always a possibility that the load on the cable might be increased by additional lines or motors. The method you suggest for earthing the motor should be quite satisfactory, provided that all joints are carefully made by soldering or clamping, but the copper tube should be sunk into ground of a suitable nature to favour good conductivity, and a proper test should be made to ensure that no appreciable resistance is encountered on the earth line.

No. 9939.—Faulty Rectifier

C.H.B. (Winchester)

Q.—Can you give me any information on the testing of Westinghouse metal rectifiers (copper oxide) and Standard Telephones (selenium). I had a suspected failure a few days ago and all I could think of was to test a.c. volts input from transformer, and d.c. output (both on load) and compare the two readings. In this case, I had a 33 1/3 per cent. loss at 10 A—input 67 V a.c. I assumed that the rectifier had served its useful life, in this case about 15 years.

R.—It is quite possible that your rectifier has become faulty over a period of years. You can test the rectifier by disconnecting it from its load, then connect an ammeter in series with the rectifier and its input supply; the meter should now show no current. If current flows under these conditions, you can safely say that the rectifier has become faulty. It is not possible to carry out repairs yourself, and the rectifier should be sent to the makers who would service it for a reasonable charge.

PRACTICAL LETTERS

Fitting Lathe Chucks

DEAR SIR,—I would like to pass on a hint to readers who have trouble with self-centring chucks not running true at all jaw openings. This is to reduce the register flange on the face of the chuck backplate by a few thousandths. The running of the chuck can then be adjusted by light taps with a lead or rawhide mallet after the holding screws have been loosened. If these screws have slotted heads, they should be replaced by hexagon- or square-headed screws for convenience in loosening and tightening. I have also found it a great help to have three $\frac{1}{4}$-in. tommy bar holes in the periphery of the backplate.

I have had this in use for many years and find I can get any diameter bar running truly in much less time than by using the four-jaw chuck. I have had no trouble with movement of the chuck, even on 2 in. dia. bar in a $3\frac{1}{2}$-in. Drummond.

Yours faithfully,

Chester A. HAYES.

Camera Construction

DEAR SIR,—*Re* Mr. J. Gordon Hall's letter on camera construction in THE MODEL ENGINEER of June 21st, would not the 9 by 12 cm. size be the most suitable? The camera is not too large, the slides can easily be adapted for $\frac{1}{4}$ plate, and need no modification for $3\frac{1}{2}$ by $2\frac{1}{2}$, whose length fits exactly across the width of a 9 by 12 cm. plate.

With a square bellows, back-focussing, large detachable lens panel, extension of approximately 15 in., a 9 by 12 cm. camera can produce first-class results from a very wide variety of subjects.

Yours faithfully,

Worksop. W. J. SALMON.

Old Steam Engines

DEAR SIR,—Having seen in THE MODEL ENGINEER the interest taken in beam engines, I thought you would be interested to learn that a Newcomen atmospheric engine installed near here is reported to be about to work again. This engine, whose early history is rather obscure, is known to have been built in 1787 and pumped water from the Barnsley seam quite a few years after the seam was worked out by Earl Fitzwilliam Colliery. The "Drainage Board" then installed electric pumps which were flooded out and the beam pump put to work for a matter of 18 months round about the year 1934, as best I remember. The engine is in its original form but the beam, which was of wood, was replaced by a cast-iron one and the chains which attached piston and pump-rods removed and parallel-motion gear fitted. This beam was cast locally, but no-one seems to know where Graham's Foundry, at Elsecar, really was. Fitters are putting it in order now and I hear a whisper that "Shell-Mex House" have viewed it and intend to make a film of it when it is ready. True or not, the pump house is the scene of a lot of activity.

Cylinder is 10 ft. high, 4 ft. 4 in. dia. It makes six strokes per min., pumps 50 galls. per stroke at a single lift of 43 yds. B.H.P., 11.4; bucket, 18 in. dia.; working pressure $1\frac{1}{2}$ to $2\frac{1}{2}$ lb. per sq. in.

Mr. Gerald T. Newbould pointed out to Mr. J. H. W. Laverick, of Tinsley Park, at a reading of a paper before the Manchester Geological and Mining Society, by Mr. W. T. Anderson in 1918, that the "Old Elsecar" engine was built four years before the Pentrick engine.

I wish to point out I'm not an authority on beam engines, but I had just been reading a paper by Mr. G. T. Newbould in an effort to gain information of this local engine as my first effort at modelling takes that form, and I had just picked up the June 28th issue of THE MODEL ENGINEER and saw mention of the Pentrick engine in there also.

I thought you may like to inform other readers that one of these fine machines was to work again (but not pump, as there are electric pumps in the shaft) 164 years after being built.

Yours faithfully,

Elsecar, nr. Barnsley. C. DRURY.

"Britannia"

DEAR SIR,—I was sorry to read the criticism of a really fine locomotive and one, moreover, which meets the practical conditions of today rather than the fads of the designer.

Today's conditions are such that inside motion is a terrible liability in most running sheds, while on the road so are locomotives which do not steam on bad coal, fired by a semi-skilled fireman. A wide firebox was the only possibility, and this, coupled with the progressive replacement of light rails and bridges, indicates very clearly why the first British 2-cylinder Pacific was built.

It is my opinion that the introduction of a progressive locomotive of this kind will have an effect on operation as revolutionary as that of Stanier's 5P5F on lighter duties ten years ago; a design which incidentally, is being perpetuated by No. 73000.

Be that as it may, I certainly propose to visit Great Eastern territory this year and I hope Mr. Keiller and Mr. Sproson do, too.

Yours faithfully,

Wolverhampton. J. B. HOLLINGSWORTH.

Emett Locomotives

DEAR SIR,—In THE MODEL ENGINEER for June 28th, Mr. Barnett calls for more realism in models of Emett locomotives. I should like to follow this with another plea. Let us have no more working models of Emett locomotives. These caricatures depend for their effect upon gross exaggeration of the normal parts of a locomotive and are frankly fantastic; they exhibit no humorous mechanical ingenuity—the kind of thing that made the late W. Heath

Robinson famous—and from an engineering point of view are a total loss.

Even at the risk of having my sense of humour and/or aesthetic taste called into question I must confess that they make little appeal to me. Buffers two or three yards long seem neither clever nor funny, nor can I wax enthusiastic over a fifteen foot chimney which looks like a cross between those of an old time Mississippi steamboat, and the Woolwich Free Ferry. Nor do I see any charm in a boiler with a back like a dachshund.

That these aberrations have their following is obvious—everyone to his taste—and if anyone wishes to model them, all well and good, but I submit that it is a waste of effort, and a prostitution of model engineering to make them work. I agree with Mr. Barnett that they should be "——thrown off casually by silversmiths——," and for my part the further off they throw them the better.

Yours faithfully,

New Eltham. A. L. HUTTON.

CLUB ANNOUNCEMENTS

Aylesbury and District Society of Model Engineers

At a recent meeting of the club, Mr. Hasberry gave a talk to members on that very intricate subject "The Locomotive Valve-gear." Mr. Hasberry talked from personal experience, having had to modify the valve-gear on the L.N.E.R. J.39 he is building.

Hon. Secretary: E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

International Radio Controlled Models Society

The Hon. Secretary, T. F. Sutton, has had to resign, and at present the Acting Secretary is C. H. LINDSEY, 292, Bramhall Lane South, Bramhall, Stockport, Cheshire.

There will be a meeting of the Tyneside Group on Friday, August 24th, at 7.30 p.m., at 176, Westgate Road, Newcastle-on-Tyne, This will be an "Experimental Evening."

There will be no meetings of the other groups during August.

The Ramsgate Model Club

This year, in place of the annual exhibition, an "At Home Week" will be held in the club's premises from September 3rd to 8th, from 6 to 10 p.m. daily and from 3 to 10 p.m. on the Saturday. The idea is to have a demonstration of every activity of the club going strong with a display of members' models.

Guests are invited from local patrons, modellers, etc., on special days, leaving Tuesday and Friday evenings open to anyone who would care to come and see over the club. On the Saturday it is hoped that clubs as such will pay a mass visit and secretaries of same that would like to come are asked to contact the club first so that arrangements can be made to make it a perfect day for them.

During the past year the Ramsgate Model Club has made good progress, reflected in the increased membership and a more intensive programme of interesting visits to places of a mechanical interest. Apart from the annual outing, when the members went all over the train ferries at Dover, visits have been paid to Richborough Rubber Works, the Telephone Exchange, Advance Laundry and the printing of the local paper, etc.

During the summer months the workshop is open only on Friday evenings, with two of the above visits on the second and fourth Wednesdays.

Visitors are always welcomed at the club in Princes Street, off Queen Street, on Fridays, from 7 to 9 p.m.

Hon. Secretary: R. W. CRIPPS, 1, Cordington Road, Ramsgate, Kent.

The Edinburgh and Lothians Miniature Railway Club

An inaugural meeting was held on July 6th, 1951, in the Edinburgh Chamber of Commerce and was attended by well over 30 enthusiasts. After full discussion, the club was formed, officers elected (including a committee of six), and policy defined on broad lines. The objects are, *inter alia*, the promotion of the hobby or craft of the construction and operation of miniature railways accurately to scale and realistically operated. The intention is to press on with the negotiations for acquiring a disused railway station as premises wherein to construct layouts in gauges "O" and "OO" and to operate such layouts exactly as in full-size practice. They will be built to British prototype, but to a much higher standard than anything yet seen in this country in club layouts and will be comparable with the best of the American club productions. Anyone conversant with the latter's work, even from photographs, will know something of what lies ahead of the new club.

There is also the possibility of the Edinburgh Society of Model Engineers setting up their test track for steam locomotives in the grounds of the station. Several of their members are among the thirty-odd who came to the inaugural meeting, paying the registration fee of 5s., which is on account of the first year's subscription. The new club is fortunate that the first chairman is Mr. J. H. Farr, who is secretary of the Edinburgh Society of Model Engineers. All enthusiasts in the district are urged to join. The more there are the greater the prospects of early success.

Secretary: W. LOCH KIDSTON, 6, Chester Street, Edinburgh, 3.

Malden and District Society of Model Engineers Ltd.

On August 26th, from 11 a.m., The South Eastern Association of Model Engineers locomotive gala day will be held at the Malden Society's track, Claygate Lane, Thames Ditton.

Visitors welcomed. Refreshments available.

Hon. Secretary: G. C. SMITH, 101, Tudor Drive, Kingston, Surrey.

The Northern Association of Model Engineers

Entries may still be sent right up to the date of the *Daily Dispatch* great Festival of Britain international radio-controlled model boats contests, and model yacht and model power boat regatta, to be held on the Model Yacht Lake, Fleetwood, Lancs, on Saturday, Sunday and Monday, August 4th, 5th and 6th.

Entry forms may be obtained from: D. Riley, 3, Tarnbrook, Pilling, nr. Preston; R. Lawton, 10, Dalton Avenue, Whitefield, nr. Manchester; or the Hon. Secretary, W. J. THOMPSON, 16, Prestwood Road, Salford, 6.

P.A.D.S.M.E.E.

The Plymouth and District Society of Model and Experimental Engineers was recently given a very interesting and instructive demonstration of the welding and brazing of ferrous and non-ferrous metals by the British Oxygen Company.

The demonstrator explained the procedure and pointed out the pitfalls while he worked, and members were able to learn sufficient to help them over the many difficulties which the amateur encounters in his own workshop.

Hon. Secretary: H. A. TUCKER, 42, Cobbett Road, Honicknowle, Plymouth.

Whitchurch (Glam.) and District Model Engineering Society

Members of the above society recently made a very instructive visit to Swindon Locomotive Works, from which much useful information was gained. The electric railway layout in the workshop is now well under way and the rails, etc., have now been obtained for the live steam section. The marine section is also hard at work and there are now five power craft between 2 ft. 6 in. and 4 ft. 6 in. long being constructed.

At a recent meeting of the society we received a visit from Mr. R. B. Collinson, a member of the Newcastle-upon-Tyne Society. If any other modellers visiting, or intending to visit Cardiff would care to call, we will be very pleased to welcome them. Membership of the society is steadily increasing but there is still room for new members. Anyone interested should contact the Hon. Secretary, W. D. HARRIS, 177, Whitchurch Road, Gabalfa, Cardiff.